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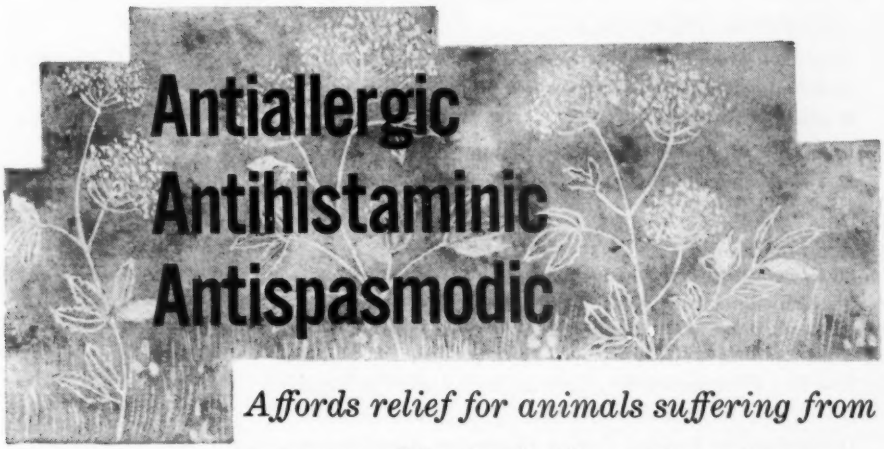

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Special Report

Why You are Vaccinating Fewer Hogs for Cholera

The most recent estimate provided by the U.S.D.A. indicates that approximately 40% of the hogs in the U.S. were vaccinated against cholera in 1960. Despite a small increase over 1959, recent years have shown a steady decline in the use of hog cholera vaccination by farmers. The percentage of hogs vaccinated against hog cholera declined from an estimated high of 57% in 1950 to approximately 36% in 1959.

To determine the cause of this trend and what might be done to reverse it, the Hog Cholera Serum Control Agency appropriated a substantial sum of money so that the expert research firm of Elrick and Lavidge, Inc. might study the problem.

After preliminary exploration, interviews were conducted, in person, by members of the firm's research staff. Included in these contacts were 177 hog farmers, 41 veterinarians, 19 county agents and 19 other influential persons such as extension workers, G.I. instructors, bankers, druggists and feed dealers, for a total of 256 contacts.

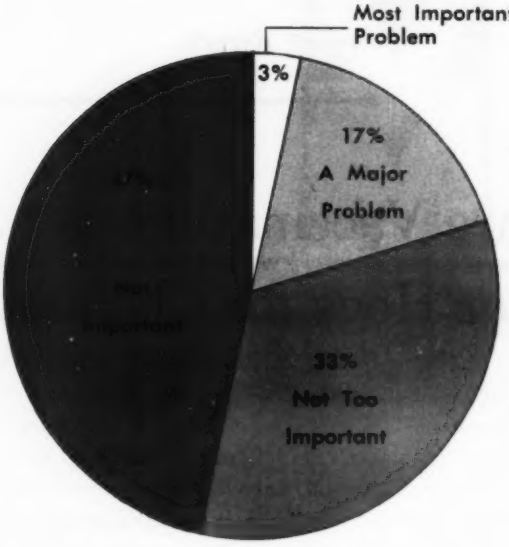
A systematic selection of 8 states and 19 counties within these states, provided the areas in which the interviewing was conducted. The 8 states included were Minnesota, Iowa, Missouri, Illinois, Indiana, Georgia, Kentucky and Tennessee.

Exploratory work had indicated that one reason for the decline in hog cholera vaccination was lack of concern on the part of farmers and influential people in the community. According to this study, only about 1 out of 5 farmers and about 1 out of 4 influential persons consider cholera to be a major hog raising problem. Furthermore, there are indications that the publicity given to cholera and cholera control methods may suggest to many farmers that the disease has been eradicated and no longer is a major threat.

If farmers had heard of recent outbreaks or had experienced cholera on their farms, they were more concerned, but neither group had a high degree of concern about the disease. Farmers and influentials tend to regard other hog diseases and illnesses as more serious problems. For example, one-half of farmers and slightly over one-half the influential persons indicated that erysipelas is the most serious hog illness confronting the raiser. The great multitude of hog diseases and management problems serve to minimize their concern about hog cholera.

Thus it is apparent that neither hog farmers nor persons most likely to influence them are really concerned about hog cholera.

FARMERS CONCERN ABOUT HOG CHOLERA



The concern of 79 influentials about hog cholera was very similar. Only 3% considered it to be the most important hog raising problem, 20% thought it was a major problem, 35% not too important and 42% considered it not to be important.

177 Respondents

About 1 out of 10 of the farmers contacted believe that cholera outbreaks will become more frequent in the near future. Many are of the opinion that the incidence of cholera will decline in the future. Almost one-half of the potentially influential persons felt that there will not be any substantial increase in the incidence of the disease.

This complacency among farmers and influentials is based upon their conviction that the present incidence of vaccination is adequate to prevent increased outbreaks of hog cholera. Many of the farmers indicated that it is not necessary for them to vaccinate their hogs because there are enough other farmers who vaccinate to prevent the spread of the disease. Moreover, the development of the modified vaccines has contributed to the feeling that cholera is under control.

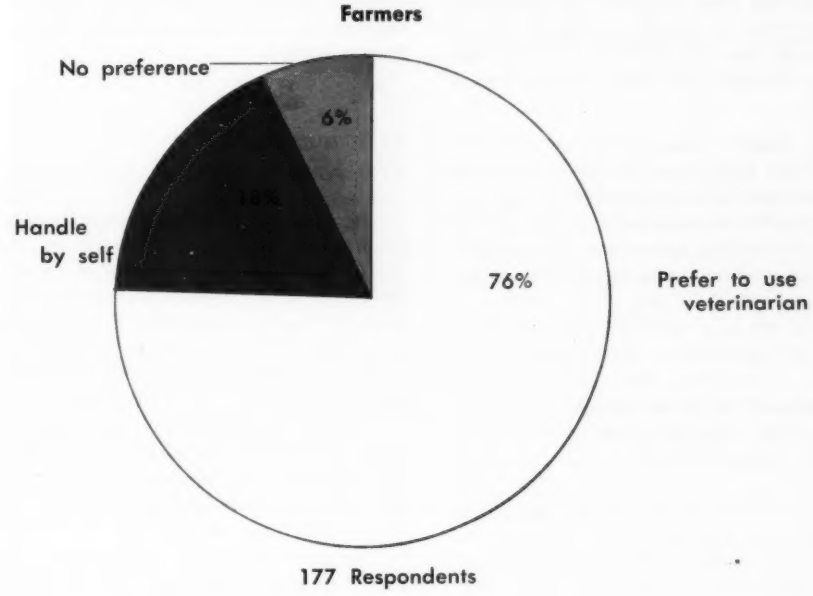
There was ample evidence that a majority of farmers believe that vaccination is the most effective way to control cholera but it is apparent that many farmers and influential persons have mistaken conceptions about cholera. For example, some believe that proper sanitation is an effective way to control the disease. Others suggested that cholera can be controlled by proper diet.

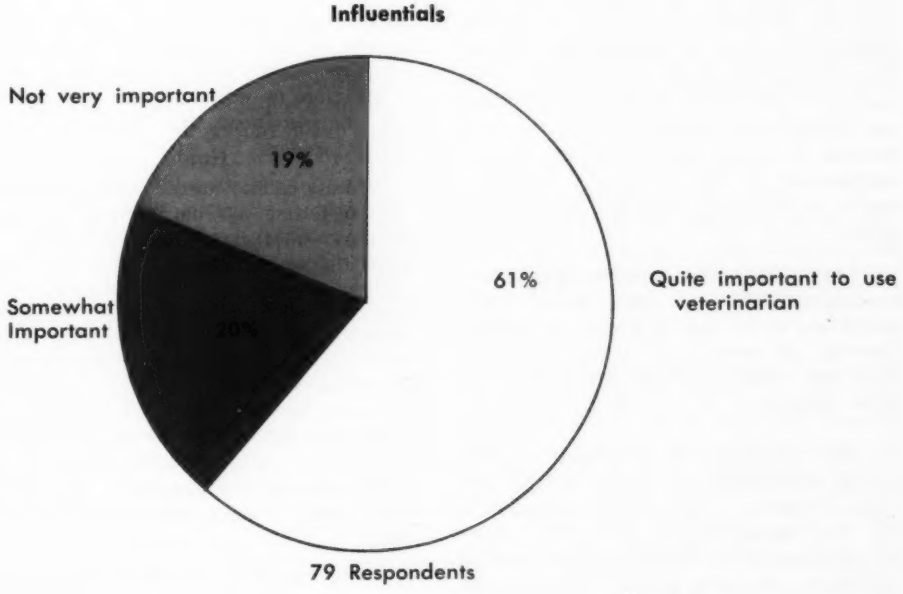
Only about 1 out of 4 of the farmers contacted had ever attended a class or meeting at which hog cholera was discussed. Relatively few of those who have attended such meetings have done so within the past 3 years.

Many of the influential persons are of the opinion that the farmers in their area either are misinformed or have little knowledge about the disease. They suggest that farmers frequently are not aware of the severity of the disease, that they do not understand the principles of immunization and that they are not aware of how their hogs can become infected.

It appears that few farmers have had the opportunity to obtain precise and clear knowledge about the nature of the disease, its severity, and the basic principles of control.

SHOULD VETERINARIANS BE USED TO VACCINATE HOGS?





While most hog farmers regard vaccination as the most effective way to control or eliminate hog cholera, this is no guarantee that they actually will vaccinate their own hogs. In deciding whether or not to vaccinate, farmers tend to calculate the odds that cholera will strike if they do not vaccinate.

Hog cholera vaccination is regarded in much the same way as insurance. The potential risks are compared with the potential benefits obtained at a given cost. A decision is based upon the estimated chances of escaping an outbreak if vaccination is not used. The cost of vaccination is important, but is a relative value. Even if the cost of vaccination were reduced substantially, it is likely that many farmers would consider it to be excessive because they view the risks involved in not vaccinating as being minimal.

The incidence of vaccination is highest among farmers who have had personal experience with cholera and those who have sold the most hogs in the past year. Outbreaks of cholera appear to leave strong, vivid memories of their effects. This provides the stimulus for a period of time to continue vaccination against the disease. However, the difference in incidence of vaccination among those who have had cholera and among those who have not is not substantial. It is necessary to remind farmers continuously of the potentially disastrous results which occur from hog cholera outbreaks.

Larger operators probably have a better understanding of costs and a better realization of the potential risks in not vaccinating. An outbreak of cholera on a large farm can result in large dollar losses to these farmers.

The attitudes of influential persons toward vaccination are similar to the attitudes of farmers. One notable exception is that the influentials, particularly veterinarians, tend to be of the opinion that all vaccination should be done by veterinarians.

In addition to this major difference in attitudes, the influentials appear to be slightly more convinced of the need to vaccinate than are the farmers. The problem of stimulating farmers to vaccinate routinely narrows down to convincing them of the substantial risks they run if they do not use this procedure.

Veterinarian The Key Man

In this investigation several indications were found that veterinarians are potentially, the single most important source of influence upon farmers' attitudes toward cholera. Veterinarians were mentioned most frequently as the best source of information by farmers (93%) and by influential persons (82%).

In the opinion of the investigators the most direct, and potentially most fruitful, way to raise the level of concern among hog farmers about hog cholera is to obtain direct aid from veterinarians in a program to stimulate increased vaccination. Almost 3 out of 4 contacted report that they usually do not suggest to farmers that their hogs should be vaccinated unless asked. Most said it would not be ethical. Further investigation of this question led the research team to believe that this inactivity is not a question of ethics. Many veterinarians are not convinced that hog cholera is a major problem.

Many county agents and other influentials feel that veterinarians are not doing all they can to stimulate vaccination, but think they are too busy.

These highlights from a very comprehensive and commendable study clearly point to the practicing veterinarian as the key man to increase numbers of swine vaccinations against cholera. Your local physician does not hesitate to recommend polio vaccine for your children. What do you think? Should veterinarians take a more active role in urging hog cholera vaccination?

Your thoughts and ideas would be appreciated. Write editor, VETERINARY MEDICINE, 606 Livestock Exchange, Kansas City, Missouri.

PRACTITIONER'S BOOKSHELF

Veterinary Hematology by Oscar W. Schalm, 286 pages, illustrated. Lea and Febiger, 600 S. Washington Square, Philadelphia 6, Pa. Price — $9.50.

This book is devoted exclusively to veterinary hematology and its interpretation. The subject matter of this volume is based on a search of the English literature for published data on the blood morphology in domestic animals and original data on the blood of the dog, cat, cow, sheep, goat, horse and pig in health and disease from 30,000 blood samples examined by the author during the past 10 years.

Approximately the first third of the book is devoted to materials, equipment and technics for examination of blood specimens as well as fundamental concepts to aid in interpreting blood changes. The middle third of the book covers an illustrated and explanatory description of cells of peripheral blood of the domestic animals. Also included are the normal blood values of each domestic animal. The physiology and pathology of the hematopoietic system are discussed with particular emphasis on the anemias. The leukemia complex is presented and how it applies to each animal. Finally, the blood pictures in some common diseases of domestic animals are presented as well as 27 case histories in the appendix giving the blood picture in each case.

Horseshoes of Interest to Veterinarians by the late Dr. Henry Asmus, 24 pages, illustrated, the 3rd edition now owned and copywrited by Ken Kimble, Plant City, Florida. Price — $1.00.

This booklet contains illustrations and an explanation of 151 various types of horseshoes. The third edition of this booklet has been revised and brought up to date by Dr. R. A. Asmus, son of the late Professor Henry Asmus who taught horseshoeing at Cornell University.

The Infectious Diseases of Domestic Animals by William A. Hagan and Dorsey W. Bruner, 1,033 pages, illustrated. Comstock Publishing Associates, Ithaca, New York. Price — $11.50.

The fourth edition of this text is an attempt by the authors to keep abreast with current information. All parts of the book have been brought up to date, but the original format has been retained. Of particular interest is the addition of an introduction to the section on viruses which deals with the speculated nature of viruses.

Kennel Building and Plans by Will Judy, 111 pages, illustrated. Sixth edition. Judy Publishing Company, Box 5270, General Postoffice, Chicago 80, Illinois. Price— $4.00.

This well-illustrated volume is a practical discussion of all phases of kennel construction. Every detail is covered, from location and types of materials to equipment and legal aspects. One chapter is devoted to plans and observations on veterinary hospitals. Probably the better part of this edition is the addenda that presents the story and description of various kennels in the United States. The many problems that may be encountered in kennel construction are discussed.

Tularemia Epizootic in Sheep

A Review of the Disease And Controlled Clinical Study of Treatment

Floyd W. Frank, D.V.M.
William A. Meinershagen, B.S.
Caldwell, Idaho

Tularemia is an infectious disease of animals, especially wild rodents, and secondarily of man, caused by the pleomorphic Gram-negative microorganism *Pasteurella tularensis (Bacterium tularense)*. It is of some historical significance that from its fortuitous discovery as a local curiosity, through its description and recognition as a widespread disease problem, the principal contributions to our understanding of tularemia have resulted mainly from the astute observations of American scientists. Almost unique, even among the zoonotic diseases, the varied epidemiological patterns of tularemia have attracted the interest of physicians, veterinarians, bacteriologists, conservationists, entomologists and stockmen alike.

While engaged in routine investigations of plague in the area of San Francisco, Calif., McCoy[1] in 1911 reported his observations of what appeared to be a new disease in ground squirrels *(Citellus beecheyi Richardson)* obtained from Tulare County. This new disease, which McCoy referred to

Figure 2. Note concentration of ticks under ear of the lamb. Other common areas for ticks to gather were on the ventral abdomen and between the shoulder blades. They were also scattered over the surface of the body in the wool.

as a "plague-like disease of rodents," produced pathological changes almost indistinguishable from those produced by *Pasteurella pestis,* the plague bacillus. Although initially he was able to transmit this new disease to guinea pigs, mice, rabbits, monkeys and gophers, he was unable to cultivate the causative agent on the usual artificial media.

In 1912, McCoy and Chapin[2,3] reported the successful isolation of a bacterium from guinea pigs inoculated with material from 3 naturally infected ground squirrels. They found coagulated egg yolk to be a suitable medium for cultivating the organism and described its morphology, pathogenicity and transmission. Rats, desert ground squirrels and sheep were reported to be susceptible to infection by the causative organism either through feeding or from the bite of fleas. They named the causative organism, *Bacterium tularense,* after Tulare County, Calif., where the first infected ground squirrels were found.

The first confirmed report of tularemia in man is believed to be that of a 21-year-old Cincinnati meat cutter.[4] In the fall of 1913 the patient developed ulcerative conjunctivitis, the scrapings from which produced pathological lesions when injected intraperitoneally into guinea pigs. Isolation and identification of *Bacillus tularense* was accomplished using the coagulated hen's egg yolk method of McCoy and Chapin.

McCoy and Chapin[3] had demonstrated experimentally in 1912 that *B. tularense* was pathogenic for sheep. The first report of tularemia occurring naturally in sheep was published in 1929 by Parker and Dade.[5,6] In addition to reporting 8 confirmed cases of tularemia in sheep that had occurred in the spring of 1928, the authors described a disease outbreak among sheep in eastern Montana and southern Idaho that had occurred in the spring of 1923 which, in retrospect, may also have been tularemia. Following this report, there were various papers published over the years describing confirmed cases of tularemia in sheep and the public health significance of the disease.[7,8,9,10,11] It was noted that the disease of man was often associated with handling sheep and with tick bites.

According to Marsh,[12] the first signs of tularemia in sheep are depression, lagging behind the band and stiffness of gait. The pulse and respiration rates are accelerated and the temperature is elevated (106 F. to 108 F.). Later, diarrhea and frequent urination is observed. Numerous ticks can usually be found feeding on these sheep. The disease is seasonal, occurring most frequently in April and May. Fatalities occur chiefly in lambs and yearlings. The clinical diagnosis can be confirmed by isolation of *P. tularensis,* either from swollen lymph nodes or from engorged ticks found feeding on the sheep. Guinea pigs are usually used for inoculation in an attempt to isolate the causative organism. Agglutination tests are also useful in establishing the diagnosis.

Prior to the introduction of antibiotics, treatment for tularemia was primarily symptomatic. The effectiveness of antibiotics against *P. tularensis* was first reported in

1944 when Heilman[13] found that streptomycin had a marked protective effect on experimental *P. tularensis* infection in mice. He suggested that the drug might be useful in the treatment of tularemia in man. Foshay and Pasternack[14] applied the findings of Heilman in the treatment of 7 human patients infected with tularemia. They administered 30,000 units of streptomycin intramuscularly every 3 hours for 5 days. Before the end of the first day of therapy, 6 of the patients experienced relief from the distressing general symptoms of the disease. In 1946, the National Research Council[15] reported that streptomycin was an extremely effective agent for treating tularemia, and recommended an intramuscular course of treatment consisting of about 1 gm. of streptomycin daily for 5 days to 7 days.

Because of the toxicity and certain undesirable characteristics of streptomycin, other antibiotics have also been used in the treatment of tularemia in man. Chlortetracycline, chloramphenicol and oxytetracycline have been reported to be effective. In addition, they are effective orally and are considerably less toxic.

In addition to the present report, only one item concerning the treatment of tularemia in sheep was found in the literature: Jellison and Kohls[11] mention an outbreak of tularemia that occurred in Idaho in 1952 in which 30 sick lambs were treated by injection of a single dose of streptomycin of about ½ gm. each. Most of these animals showed marked improvement the following day and only 2 died. The present report concerns the use of penicillin-dihydrostreptomycin (Combiotic, Chas. Pfizer and Co., Inc.) and oxytetracycline (Liquamycin, Chas. Pfizer and Co., Inc.) in the treatment of tularemia in sheep.

Case Report

During the summer of 1958, there was a tremendous build-up of the mouse and rabbit populations in western Idaho. That fall, reports of extensive rodent damage to field crops appeared frequently in the local press. Following this population build-up, an epizootic apparently spread among the rodents, and in the spring of 1959, large numbers of dead and dying rabbits were observed throughout the area. By early summer, the mouse and rabbit population had almost completely disappeared.

This was the situation in the area (northern Owyhee County, Idaho, and eastern Malheur County, Oregon) when the sheep were turned out on the sage brush range on March 26, 1959. Four separate

Figure 3. Sheep of Group I *from Band 1. These lambs were so sick the herder is pushing some to get them to move. Note ewes far ahead of the lambs.*

Figure 4. Sheep of Group I from Band 1 after spraying. Some of these lambs are down and dying.

groups came under our observation; each group consisted of 1 or more bands of ewes with their lambs.

Group I consisted of 3 bands of sheep. There were 1,275 ewes with 1,275 lambs in band No. 1. On April 8, a number of sick and dead lambs were observed in this band; a similar situation existed in other bands in the area about the same time. The herders reported that the lambs were heavily infected with wood ticks and it was assumed that this infestation was the cause of the trouble. On April 14, 1959, the ewes and lambs in band No. 1 were corralled and sprayed with 0.5% toxaphene. Closer observation of the sick lambs at that time revealed signs of scouring, depression, stiff gait and lagging behind the band. A tentative diagnosis of tularemia was made on the basis of the preceding rodent epizootic, heavy tick infestation, diarrhea, depression and temperatures ranging up to 107 F. This diagnosis was later confirmed by isolation of *Pasteurella tularensis* from the lymph nodes of lambs that had died.

About half the sick lambs were treated; the remainder were observed as a control group. Among those treated, 300 lambs were given an injection of 2 cc. of penicillin-dihydrostreptomycin and 90 were given injections of 3 mg. to 5 mg. of oxytetracycline per lb. of body weight. In most lambs it was apparent that local transient pain was associated with the administration of oxytetracycline. The treated lambs were marked for future identification and returned to the range.

In the week prior to treatment, 130 lambs in the band had died. Between April 14 (the day of treatment) and noon of April 18, only 32 lambs died. Thirty of these were from the control group (untreated), one had received penicillin-dihydrostreptomycin and one had received oxytetracycline. In the lambs treated with oxytetracycline there was considerable improvement over both the untreated controls and those treated with the penicillin-dihydrostreptomycin. Although visibly improved, a good many of the penicillin-dihydrostreptomycin treated lambs were still scouring and lagging behind the band. Those that could be caught were treated a second time. The oxytetracycline treated lambs appeared to have completely recovered, and it was difficult to get close to them on the range. Between April 18 and May 8, 250 additional sick lambs in this band were treated with oxytetracycline, with only 2 deaths.

Heavy losses from tularemia also occurred in band No. 2, of Group I, which consisted of 700 ewes and 1,350 lambs. By April 19, 285 deaths had occurred in this band. On that date, 300 sick lambs were treated with oxytetracycline, after which no more losses were reported. Sick lambs in band No. 3 were not treated; 175 died. This band was composed of 900 ewes and 1,200 lambs.

Group II consisted of 10 bands of sheep, totaling 10,000 ewes and 15,000 lambs. At least 3,000 of these lambs were very sick and 1,100 died. Information regarding treatment is not available for this group. Ticks were collected from these sheep and *P. tularensis* was isolated from guinea pigs injected with a preparation of macerated ticks.

Group III consisted of one band of 1,000 ewes and 1,300 lambs. There were at least 300 sick lambs in this group, of which 65 had died. *Pasteurella tularensis* was isolated from the lymph nodes of the dead lambs. Treatment with oxytetracycline (3 mg. to 5 mg./lb. of body weight) was effective in reducing further losses.

Group IV consisted of 2 bands totaling 1,800 ewes and 2,200 lambs. After 950 lambs became sick, control was attempted by spraying with benzene hexachloride. This seemed to prevent new cases from developing, but the death losses continued among the sick lambs. There were 140 deaths in this group before treatment with oxytetracycline was started, after which the lambs recovered with few, if any, further losses.

Summary

A previously unreported epizootic of tularemia in sheep that occurred in the spring of 1959 in western Idaho is described. Sixteen bands in 4 separate groups (15,675 ewes and 22,325 lambs) involved were under observation. Death losses totaled at least 1,925 lambs; in addition to an average 4 lb. less in shipping weight per lamb over previous years. Treatment with 2 cc. of penicillin-dihydrostreptomycin or 3 mg. to 5 mg./lb. body weight of oxytetracycline was successful in reducing further losses. Prompt clinical response and sharply reduced death losses indicate that oxytetracycline was the more effective treatment for tularemia in sheep.

From the University of Idaho Agricultural Experiment Stations, Caldwell Branch Station, Caldwell, Idaho. Published with the approval of the director of the Idaho Agricultural Experiment Station, Moscow, Idaho, as Research Paper No. 510.

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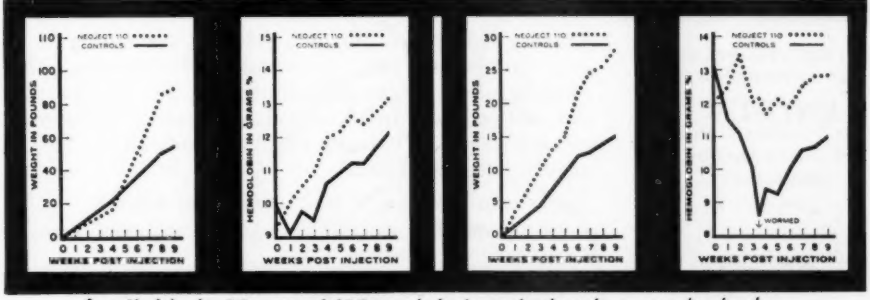

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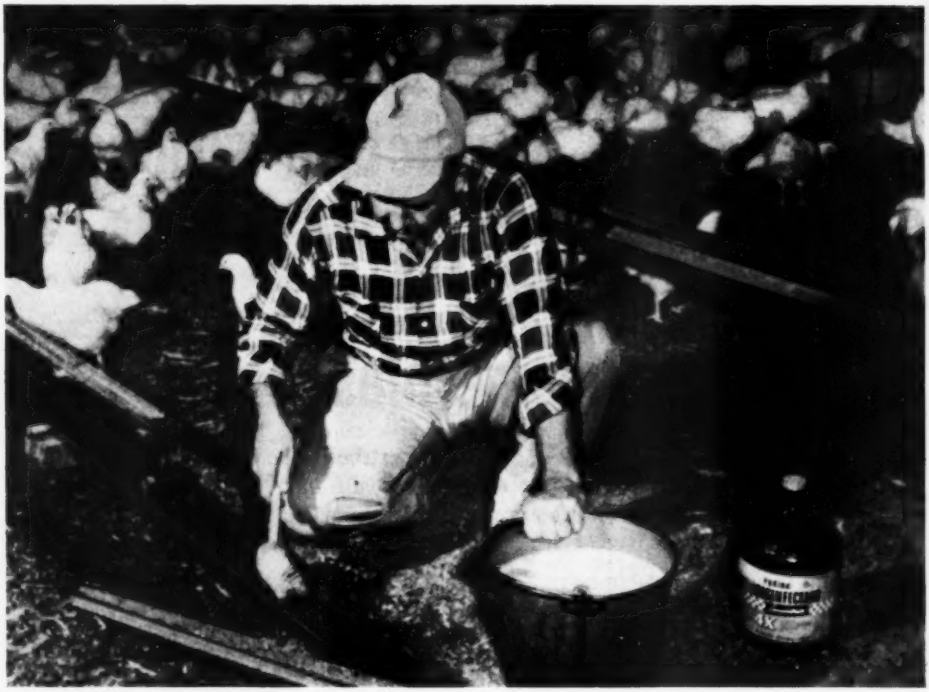

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Nitrofurazone in Treatment of Bovine Mastitis

Robert Jackson, D.V.M.
Ontario, California

Mastitis is one of the most prevalent and expensive diseases of dairy cattle and imposes a hidden tax on dairy profits. Every lump of scar tissue and every inflamed duct in the cow's udder subtract a little from total production of milk and butter fat on the nation's farms. Many dairy farmers carry the burden of chronic or mild mastitis simply because they are unaware of its presence or are not willing to pay for its treatment. Acute mastitis is familiar to everyone concerned with dairy cattle and is a constant challenge to the veterinarian and the dairyman.

Mastitis may be defined as inflammation of the udder. Broadly, this may include physiologic engorgement of the mammary gland at parturition, bruises, lacerations, chafing of the skin against the legs and damaged teats from either trauma or pox. In a strict sense, mastitis means infection of the mammary gland[1] by bacteria (*i.e.*, *Streptococcus* sp., *Staphylococcus* sp., *Corynebacterium* sp., *Escherichia coli* or *Pseudomonas* sp.) and other organisms of lesser importance.

Many antibiotics and chemotherapeutic agents have been used in treatment of this disease with variable results. Recently a new class of antimicrobials, the nitrofurans, has received considerable attention in veterinary medicine. One of these, nitrofurazone (Furacin, Eaton Laboratories), has been employed extensively in animals for topical prophylaxis and therapy of bacterial infections, mainly dermatologic and genital and recently in control of mastitis.[2,3,4,5] Nitrofurazone has proved bactericidal, milk-miscible, nonirritating to tissues or mammary gland and has shown no adverse effect on healing. Development of bacterial resistance to this drug is reportedly minimal.[6]

Mires and Chadwick[3] in 1947 reported 90% effectiveness in treatment of mastitis in dry and lactating cows with intramammary injections of 20 cc. to 80 cc. of 0.2% aqueous solution of nitrofurazone. In 1951, Mires[5] reported marked improvement in a total of 7,104 mammary quarters, with complete clinical cure in 6,536 (92%), following intramammary injections of 25 cc. to 40 cc. of a nitrofurazone-penicillin preparation containing 4,000 units of penicillin per cc. Roberts *et al.*[4] in 1953 reported 100% clinical cure and bacteriological cure in all but 3 of 19 quarters of 10 cows treated with a nitrofurazone-penicillin gel (Furacin-Penicillin Gel, Eaton Lab.) by using 1 or

2 courses of 2 to 3 intramammary injections, totaling 150 mg. of nitrofurazone and 100,000 units of penicillin per each dose of 7.5 cc. Milk production increased in all cases and official bacterial count of the milk dropped to the lowest ever recorded for this herd. Vigue[5] reported 84% effectiveness in 32 quarters of 30 cows treated with 10 cc. to 20 cc. of the 0.2% aqueous solution of nitrofurazone, after 2 to 8 intramammary injections.

This report covers the use of nitrofurazone in the form of a 0.2% aqueous solution (Furacin Solution Veterinary, Eaton Lab.) for the prophylaxis and therapy of bovine mastitis in over 600 dairy cows, distributed into 3 herds.

Herd A. Table 1 shows results of screening by the California Mastitis Test (CMT) in a herd of 500 cows, 270 (54%) of which were bacteriologically positive. Samples obtained from positive quarters were plated on blood agar, and the bacteria isolated included, in order of prevalence: *Staphylococcus* sp. (hemolytic and nonhemolytic), *Escherichia coli, Streptococcus* sp., *Corynebacterium* sp., *Proteus* sp. and some unidentified fungi.

TABLE 1
California Mastitis Test Results in Herd A

Date	No. Samples	Results Neg.	Traces	1+	2+	3+
Sept. 1958	1,914	850	459	346	163	96
March 1959	1,906	1,156	414	282	43	11

Staphylococcal, *E. coli* and Proteus infections were treated with 40 cc. of this 0.2% aqueous nitrofurazone solution once daily for 3 days, with no intervening milkings. Hemolytic staphylococcal, streptococcal and *Corynebacterium* sp. infections were treated with 40 cc. of a nitrofurazone-penicillin preparation containing 2% nitrofurazone and 6,000 units of penicillin per cc. of solution. A few cases caused by a stubborn strain of *E. coli* (rough form) were treated with 30 cc. of a mixture of 1 part azosulfamide (Neoprontosil) and 4 parts of the nitrofurazone solution. Table 2 lists therapeutic results 6 months after initial treatment as follows: 76% cures, 13% improvements and 11% failures.

Herd B. This herd consisted of 342 dairy cows. Bacteriologic studies showed positive cultures in 288 (84%). Seven different organisms were isolated from these cows, which were accidentally subjected to faulty vacuum line equipment.

Staphylococcus sp. was the most prevalent organism cultured, accounting for 29% of the isolates. Coliforms accounted for 20%, followed in order of occurrence by fungi, *Pseudomonas* sp., *Corynebacterium* sp., *Streptococcus* sp. and yeast. In 36 cultures, 2 of the above organisms were isolated from each specimen.

All cows in this herd were treated upon termination of their lactation periods with intramammary injections of 40 cc. of the 0.2% aqueous nitrofurazone solution, using the same therapeutic pattern as in Herd A. Cows infected with fungi were treated with injections of 75 cc. of the nitrofurazone-penicillin preparation. Except for 29 (10%) cows infected with *Pseudomonas* sp., which responded only to polymixin B, the remaining 259 cows (90%) responded favorably to the treatment outlined.

Herd C. This herd, consisting of 198 cows, which also had been subjected to faulty pipeline equipment, showed mastitis in 48 cows (24%) as evidenced by the CMT. Of 792 quarters tested, 147 (19%) showed a CMT of 2 plus or over, 10 of which had previously been unsuccessfully treated with antibiotics.

Milk specimens from 32 quarters and 7 composite milk samples, all with CMT readings of 2 plus or over, were cultured on blood agar. Bacteria isolated consisted of *Staphylococcus* sp., *E. coli* and *Corynebacterium* sp. which were sensitive *in vitro* to both nitrofurazone and the nitrofurazone-penicillin combination.

Infected cows were treated with intramammary injections of 40 cc. of the nitrofurazone solution or the nitrofurazone-penicillin combination upon termination of the

TABLE 2

Results in Herd A 6 Months After Initial Treatment with Nitrofurazone

Organism	Number of Quarters Positive Sept. 1958	March* 1959	Intramammary Treatment	Results Recovered	Improved	Failed
Hemolytic *Staphylococcus* sp.	38	8	nitrofurazone-penicillin	40	4	2
Nonhemolytic *Staphylococcus* sp.	73	21	nitrofurazone	81	13	0
E. coli	51	19	nitrofurazone	58	8	4
E. coli (rough colony)	43	12	nitrofurazone-azosulfamide	36	11	8
Streptococcus sp.	27	8	nitrofurazone-penicillin	31	4	0
Corynebacterium sp.	14	11	nitrofurazone-penicillin	12	4	9
Fungi	16	0	none	0	0	16
Proteus sp.	8	3	nitrofurazone	8	3	0
	270	82		266	47	39
				(76%)	(13%)	(11%)
Total		352				

*Re-treated

lactation period. All cows responded favorably to treatment.

Summary

Nitrofurazone as Furacin Solution Veterinary was used alone and in combination with penicillin or with azosulfamide in treatment of more than 600 dairy cows with mastitis. In 352 cows in herd A, treatment resulted in 76% cures, 13% improvements and 11% failures. All 288 cows in herd B responded favorably to this therapy, except those with Pseudomonas infections (10%). In 48 cows from herd C, treatment was 100% effective.

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New Brucellar Antigen

A heat inactivation test may be used as a supplement to the standard tube and plate agglutination tests to aid in clarifying the brucellosis status of cattle. It was developed by Thomas E. Amerault and other scientists of the USDA.

The serum and antigens are the same as those used in the standard tube test for brucellosis. The serum-antigen mixture is heated in a water bath for 15 minutes at 65 C., then cooled immediately to 18 C., centrifuged at 1,000 times gravity, decanted, resuspended in 0.85% saline solution and examined for reaction. Any reaction of 1:25 or higher is considered positive and specific for brucellosis.

This test gave a positive reaction to all suspect and reactor cattle from which *B. abortus* was isolated in a study of 563 cattle. The bacterium was not found in any samples from cattle whose serums were negative to the test.

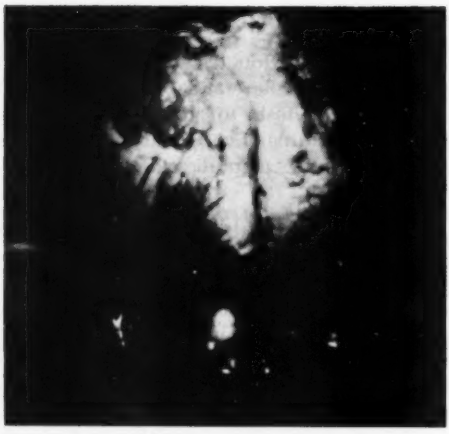
Practice Tips

When doing barnyard surgery and your last suture needle breaks, an emergency substitute may be made from a hypodermic needle. Pass the suture material through the needle, then tie a knot back into the shank of the needle. Next break off the hub of the needle and take a pair of pliers and mash the blunt end of the needle closed on the knot. Now you have an effective suture needle and if you prefer, you can put the desired curve in the needle.

Jack Cox, D.V.M.
The South Carolina Veterinarian
Vol. 1, No. 2

Following a phone call, an anxious client arrived at the hospital with a 7-week-old calf that had died very suddenly.

This calf had been turned out in a pasture for the first time a few minutes before it died. Prior to this it had been confined to a stall since birth. The animal was seen to bawl loudly, run about 20 feet and fall over within a few minutes after being turned to pasture.



All abdominal organs appeared normal at necropsy. A greatly enlarged heart was the only lesion found. It was about the size of a volleyball. The walls were very thin and were filled with clotted blood.

Q. R. Jerome, D.V.M.
West Memphis, Ark.

Suitable anti-coagulant: A satisfactory, commercially available anti-coagulant suitable for whole blood specimens may be obtained from Cambridge Chemical Products, Inc., 5850 Chase Rd., Dearborn, Mich. It is available in 1¼ ounce plastic squeeze bottles at a cost of about $2.50. Only 1 drop of anti-coagulant is required for each 5 cc. of whole blood.

Detector steer: For clients who use artifical insemination and have difficulty detecting cows that are in heat, treating a 500 lb. to 800 lb. dairy steer with repositol testosterone will stimulate sexual activity and work fairly well.

Dangers of Intramuscular Injections

Recently at a packing plant, 5,225 lb. of meat was trimmed for all types of bruises from the carcasses of a shipment of 77 choice cattle averaging 1,110 lb. Misplaced injections required the trimming of 1,200 lb. from the loins, 75 lb. from the ribs and 750 lb. from the rounds. In addition to the loss of the trimmings to tankage, the trimmed cuts must be sold as a No. 2 product at reduced prices.

The beef department of this plant states that the average loss to damaged loin from such misplaced injections, amounts to 1 cent per pound or approximately $1.00 per cwt. of the carcass. The loin loss on these 740 lb. carcasses averaged $7.40 per head. The reported total devaluation on this lot amounted to an average of $27.14 per head on the 35 bruised carcasses. This was the 3rd lot of cattle at this particular plant within a week that had damaged carcasses from intramuscular injections.

Improper injection prior to shipment is causing as much loss in damaged carcasses as bruising during shipment. If animals for slaughter must be injected at shipping time, the injection should be made in the upper part of the neck as near the head as possible. There are much cheaper cuts of meat here.

Ray L. Cuff
Midwest Livestock Loss Prevention Board

Use of a Cerumenolytic Agent as an Adjunct in Treating Otitis Externa

Morton Gradess, D.V.M.
Jenkintown, Pa.

When otitis externa is present in small animals, the problem of effectively cleansing the ear canal can be particularly troublesome. Instrumentation may further traumatize the already damaged or irritated lining of the ear canal. Yet, before any form of otitis externa can be adequately treated, the external auditory canal must be cleared of cerumen and exudates. Cleansing the canal will often permit the otitis to resolve without further medication.[1]

Most agents commonly used to remove ear wax (ether, alcohol, surgical soap and detergents) have basic drawbacks. Either they are ineffective or, if they do work, they are extremely irritating or painful to sensitive mucosal lining of the canal and tend to aggravate inflammation and infection. Even when the wax is softened by the agent used, instrumentation is necessary for complete removal. Instrumentation or use of pressure syringing against the tympanic membrane are both painful and potentially dangerous when otitis externa is present.

A cerumenolytic preparation that has proved extremely effective in humans[2,3] was used in this study in its veterinary form (Cerumenex Veterinary, Drugs for Veterinary Medicine, Inc., N. Y.) in an attempt to discover a safe and effective method for removal of ear wax in small animals. This preparation has a base of propylene glycol containing 0.5% chlorbutanol and 10% triethanolamine polypeptide oleate-condensate. The resulting solution is water-miscible and acts by disorganizing and solubilizing both the protein matrix and the lipid portion of the cerumen. This solution is readily miscibile with the propylene glycol and easily removed by syringing with water. Since most exudates of the external ear are proteinaceous and composed of shed epithelium and serous oozings as well as cerumen, the same chemico-physical approach applies.

There were 31 small animals in this study including 25 dogs, 5 cats and 1 rabbit. The animals were divided into 3 groups by diagnoses rather than species. The first group had parasitic otitis and consisted of 1 rabbit, 5 cats (2 Siamese and 3 Persian) and 2 dogs (1 cocker spaniel and 1 pomeranian). In this group, wax and exudate had built up around the offending parasitic invaders, sometimes to a point where the entire lumen of the canal was occluded. The

second group consisted of 4 dogs with acute purulent otitis externa. There were 2 cocker spaniels, 1 schnauzer and 1 crossbreed in this group. In all 4 dogs, excessive wax and exudate provided a continuing source of irritation and infection. The third group consisted of 19 dogs with chronic otitis externa. Among these were 2 wire-haired terriers, 2 boxers, 6 poodles, 1 Scotch terrier, 4 cocker spaniels, 1 dachshund and 3 crossbreeds. In most of these dogs the wax was unaccompanied by any discharge, but it was heavy and inspissated and sometimes lodged against the tympanic membrane.

The following method of treatment was used: 3 to 10 drops of the cerumenolytic agent were placed in the external ear canal and the ear gently massaged on the outside. A pledget of cotton was then used to block the canal. This not only served to retain the cerumenolytic within the external canal, but also absorbed any excess liquid. The agent was allowed to remain in the canal for 1 hour. The ear was then gently irrigated with warm water. This treatment was repeated daily, as necessary.

Results

In every case complete success was achieved in cleansing the canal with the cerumenolytic alone. There was no need to resort to instrumentation or pressure irrigation, even in those stubborn cases with hard, dry, impacted wax. Although the length of time needed to achieve thorough cleansing varied in proportion to the amount and condition of the wax and severity of the infection, in no case did it exceed 4 days. The most impressive results came from ability of the cerumenolytic to liquefy inspissated wax lodged against the tympanic membrane.

In the first group, 3 instillations were necessary to clean the canal in the rabbit and 2 to 3 in the 5 cats and 2 dogs. This was followed with antiparasitic medication which successfully removed the mites. In the second group with acute purulent otitis externa, 1 or 2 instillations successfully cleaned the ear canal in all cases. The third group with chronic otitis averaged 2 instillations; the longest period was 4 instillations and the shortest was one. In all 19 animals in this group there was complete wax removal. There was no evidence of side reactions due to use of the cerumenolytic agent even when 4 instillations were used.

The external auditory canal in dogs describes an acute angle with gradual stenosis of the lumen by the annular cartilage telescoping into the auricular cartilage.[4] This forms an almost sealed-in area which tends to accumulate and retain cerumen.[5] This pocket formation, whether or not aggravated by long ears and overgrowth of hair, is particularly conducive to a high incidence of otitis.[3] Parasitic invaders of this nidus serve as foci for the building up of additional layers of cerumen which further enclose the canal and propagate a breeding ground for infection.

In cats, the external auditory canal is short, blunt and open. We rarely find otitis externa unless caused by parasitic invasion. Here the blockage caused by mites as well as the trauma of their biting initiates infective process. In our series there were only 5 cats needing cerumenolysis and these had parasitic otitis *(Otodecta cynotis)*.

Effective pharmacological removal of wax without trauma to the external auditory canal or tympanic membrane was achieved in all animals involved in this study. This was true whether the wax was soft and malleable or hard, dry and packed against the drum. It is interesting that in the second group with acute purulent otitis only 1 or 2 instillations were necessary. In this type of otitis there is rarely any hard and dry wax. The canal is kept too moist by continuous discharge.

The third group of animals with chronic otitis required the largest number of instillations. This is in line with the nature of chronic otitis, a condition characterized by accumulated masses of cerumen. The danger of neglecting chronic otitis is great and can lead to impairment of hearing, a gradual thickening of the canal lining and in time, a chronic ulcerative otitis. When this happens, a dark tenacious discharge is mixed with the wax. The lining becomes thick and ulcerated. The ceruminous glands become hyperactive, producing excessive

quantities of wax. Eventually, fibrous growths and impacted wax obliterate the lumen completely.

In this study we found removal of the wax left the underlying pathology, whether due to infection or parasitic invasion, easy to control with proper medication. The cleansed lumen of the canal was readily available to antibiotic therapy when necessary, and the ear mites, once revealed, were readily removed with standard antiparasitic therapy.

Summary

A new cerumenolytic agent was tested in a group of 25 dogs, 5 cats and 1 rabbit with various forms of otitis externa complicated by excess cerumen. In all cases wax removal was complete and safe. Instrumentation was not necessary. Time of treatment ranged from 1 instillation of the agent into the ear canal to 4 on succeeding days. This preparation is a valuable adjunctive aid in the therapy of otitis externa.

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Immunization Against Canine Distemper with Distemperoid Virus

Glenn E. Taylor, D.V.M.
Fred Buddingh, D.V.M. and James H. Gillum
California Animal Research
Modesto, California

For the kennel owner, whether he be a trainer or an individual involved in research, the immunization of animals against canine distemper is of paramount importance. The following is a report on the use of Distemperoid virus as an agent for immunization in 2 kennels operating under entirely different conditions as far as work load is concerned.

Kennel I

This was a training kennel for retrievers, with an average of 50 dogs under intensive training for periods of 4 or more months. Hard pad, upper respiratory conditions and other complications of distemper were continuous problems in this kennel.

During late autumn of 1956, a gradual change was begun toward a total vaccination program with Distemperoid virus. Since that time, not one dog vaccinated with Distemperoid virus at this kennel has broken with clinical distemper. Two animals vaccinated with Distemperoid virus before being introduced into the kennel have shown clinical symptoms. Both responded to supportive therapy plus antibiotics and recovered completely.

Numerous animals vaccinated by other methods have broken with distemper. In fact, the percentage was appallingly high.

The marked difference in resistance caused the owner to institute a rule of "no Distemperoid virus, no training!" Since the complete changeover, some 270 dogs have been vaccinated with Distemperoid virus. Of interest is the fact that not only has clinical distemper been controlled, but the so-called upper respiratory syndrome has also been practically eliminated.

The transition stage was accompanied by immunization checks on pups being raised in the kennel. One half of each litter was vaccinated with Distemperoid virus and the other half with egg-attenuated vaccine. Exposure was purposely made severe and prolonged. Not one clinical break was noted in the Distemperoid virus vaccinated dogs. Thirty percent of the pups vaccinated with egg-attenuated virus broke with typical distemper. Fifty-six pups were involved in this check.

The vaccination program was as follows: Pups were vaccinated at 11 weeks of age with 1 vial of Distemperoid vaccine. Mature dogs were vaccinated with 3 mg. per lb. of Distemperoid vaccine. All vaccination was done with disposable plastic syringes and no disinfectant was used on the skin.

Kennel II

This was a research kennel composed of dogs assembled from various dog pounds. These dogs were all ages, sizes and breeds. Condition of the dogs when they arrived at the kennel varied from fair to poor, with some showing respiratory symptoms.

Group A arrived at the kennel during November, 1958. Of 80 dogs, 34 showed upper respiratory infections. Eight of the 34 showed clinical distemper symptoms. All dogs were vaccinated on arrival. Those showing symptoms of distemper were given 2 vials of Distemperoid virus. The 8 severely ill dogs were transferred to the isolation ward. Within a week, one showed nervous symptoms and was destroyed. The other animals responded clinically to supportive treatment and antibiotics and were then returned to the research kennel. Later, one of them developed encephalitic symptoms. During the first 60 days, almost all animals developed a cough, and 5 developed pneumonitis. Those with pneumonia were treated with antibiotics and recovered. No clinical distemper breaks were seen at that time or later.

Group B, a total of 48 dogs, arrived in August, 1959. All were vaccinated on arrival with Distemperoid virus using disposable syringes and no skin disinfectant, then placed in the kennel. Several younger pups developed respiratory infections, but these responded to antibiotics. To date, there have not been any losses due to infectious disease.

Practice Tips

To Prevent Horses from Biting Skin Sutures

Suture the skin with interrupted sutures of heavy gauge wire, leaving the ends long and pointing outward.

R. E. Atkinson, D.V.M.

Temporary Muzzle for a Dog

Choose a tin can of suitable size for the dog to be muzzled, then cut out each end. Wrap the sharp edges with adhesive tape and attach the muzzle to the dog's collar with a strap. This will prevent a dog from biting sutures and licking a wound.

H. B. Kinard, Jr., D.V.M.

To Prevent Irritation from Intravenous Injections

Try a 24 gauge needle instead of the commonly used 20 gauge needle if you have trouble from irritation around the site of injection.

H. W. Kinard, Jr., D.V.M.

To Kill Hookworm Eggs in Soil

A crude borax weed killer, Borascu, that can be obtained from most agricultural chemical supply houses is effective. Use it at the rate of 1 lb. per 10 sq. ft. of surface.

G. L. Lawhon, Jr., D.V.M.
The South Carolina Veterinarian, Vol. II, No. 2, Winter, 1961.

Observations and notes on equine practice gleaned from 40 years of veterinary experience by A. H. Quin, D.V.M.

Clinical Picture and Treatment of Purpura Hemorrhagica

While admittedly not common among today's horse population, purpura hemorrhagica (sometimes called petechial fever or morbus maculosis) features a 40% to 50% mortality and, at best, a slow convalescence fraught with danger of relapse. It most commonly occurs as a sequela to influenza, strangles, pneumonia or other debilitating infections, but occasional cases are idiopathic with no history of a predisposing cause. It can be defined as a disease of the blood-vascular system with hemorrhages and edema of the skin, the subcutaneous integument, the muscles, mucosae and internal organs. The leucocyte count is exceptionally high and there is a drastic depletion of blood platelets. The cause of the condition has never been clearly established.

In the early stages stocking of the limbs is noted. The edema pits on pressure and features a sharp line of demarcation. At this stage, petechiation or frank nasal hemorrhage may be seen. There is only a slight fever (seldom above 103 F.) and the pulse rate is from 80 to 100.

Fully developed edema of the head with great swelling of upper and lower lips, eyes swollen tightly shut from extensive edema and stertorous breathing indicative of pharyngolaryngeal involvement are typical. In some cases edematous swellings involve

Typical case of purpura hemorrhagica.

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To Prevent Horses from Biting Skin Sutures

Suture the skin with interrupted sutures of heavy gauge wire, leaving the ends long and pointing outward.

R. E. Atkinson, D.V.M.

Temporary Muzzle for a Dog

Choose a tin can of suitable size for the dog to be muzzled, then cut out each end. Wrap the sharp edges with adhesive tape and attach the muzzle to the dog's collar with a strap. This will prevent a dog from biting sutures and licking a wound.

H. B. Kinard, Jr., D.V.M.

To Prevent Irritation from Intravenous Injections

Try a 24 gauge needle instead of the commonly used 20 gauge needle if you have trouble from irritation around the site of injection.

H. W. Kinard, Jr., D.V.M.

To Kill Hookworm Eggs in Soil

A crude borax weed killer, Borascu, that can be obtained from most agricultural chemical supply houses is effective. Use it at the rate of 1 lb. per 10 sq. ft. of surface.

G. L. Lawhon, Jr., D.V.M.
The South Carolina Veterinarian, Vol. II, No. 2, Winter, 1961.

Observations and notes on equine practice gleaned from 40 years of veterinary experience by A. H. Quin, D.V.M.

Clinical Picture and Treatment of Purpura Hemorrhagica

While admittedly not common among today's horse population, purpura hemorrhagica (sometimes called petechial fever or morbus maculosis) features a 40% to 50% mortality and, at best, a slow convalescence fraught with danger of relapse. It most commonly occurs as a sequela to influenza, strangles, pneumonia or other debilitating infections, but occasional cases are idiopathic with no history of a predisposing cause. It can be defined as a disease of the blood-vascular system with hemorrhages and edema of the skin, the subcutaneous integument, the muscles, mucosae and internal organs. The leucocyte count is exceptionally high and there is a drastic depletion of blood platelets. The cause of the condition has never been clearly established.

In the early stages stocking of the limbs is noted. The edema pits on pressure and features a sharp line of demarcation. At this stage, petechiation or frank nasal hemorrhage may be seen. There is only a slight fever (seldom above 103 F.) and the pulse rate is from 80 to 100.

Fully developed edema of the head with great swelling of upper and lower lips, eyes swollen tightly shut from extensive edema and stertorous breathing indicative of pharyngolaryngeal involvement are typical. In some cases edematous swellings involve

Typical case of purpura hemorrhagica.

the underline, the prepuce, the shoulders or, in fact, almost any area of the body surface. Except for absence of high temperature, the case might be confused with anthrax. Necropsies reveal subserous edema, generalized petechiation and large amounts of bloody extravasations and pulmonary edema.

In former years veterinarians literally threw the book at purpura cases with claims and counterclaims made for various drugs, but with little change in the overall mortality rate. Modern therapy permits more logical approaches. These include: (1) Transfusion of from 1 to 3 quarts of whole blood, repeated as indicated. (2) Full and suitably spaced doses of the corticosteroid of choice. (3) Intravenous injection of 50% hypertonic dextrose. (4) Stimulants such as Amphetamine or Coramine to sustain heart action and an antihistamine, either parenterally or perorally. (5) The new-type injectable diuretics should be indicated.

The old timers favored a daily intravenous injection of 20 grains to 30 grains of potassium dichromate or 2 drams to 4 drams of formalin in 250 cc. of saline solution.

One admonition is that the purpura victim must be watched and nursed very carefully. No delay should prevent placing a trachea tube if dyspnea is marked. The appetite is usually retained and a gruel of rolled oats mixed with a tea made by steeping alfalfa leaves and an added cup of sugar or molasses is a suitable ration. During the recovery period, administration of a hematinic is in order.

Management of Capped Hocks

A swelling over the hock.

Etiology: Bruising.

Symptoms: The bursa is enlarged.

Prognosis: Guarded.

Treatment: Apply heat in early cases and prevent further injury by covering hock with a pack. Aspiration of the fluid, then injection of Lugol's iodine has been used.

Practice Tips

A good veterinarian never examines a horse's foot for a puncture wound or other pathology without first removing the shoe.

Diarrhea is common in foals during the 9-day post-foaling estrus of the mare (the so-called foal heat). Few things are more efficacious than 15 to 30 drops of paregoric repeated at 4 to 6 hour intervals.

One of the first things to do when multiple cases of glossitis and stomatitis occur in a stable of horses is to check hay for presence of sandburrs.

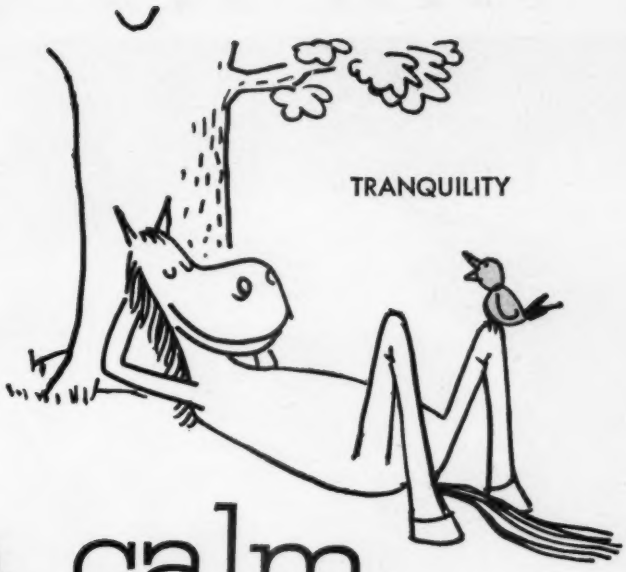
A snorer may mean the presence of a nasal polyp in one nostril. Detection calls for good restraint and a careful examination. If a nasal polyp is simply snared and pulled off from its point of attachment, it will regenerate in a short time. One satisfactory method of removal is to trephine slightly below the anterior limit of the frontal sinus and just to one side of the median line.

In areas where face flies torture horses on pasture, considerable relief can be obtained as follows: Take a length of rawhide thong (boot lace type) long enough to circle the head at the ear base. At 2-inch intervals tie a 10-inch length of rawhide thong. In other words make a fly net. Be sure to tie the head band firm enough to hold, but not tight enough to shut off circulation.

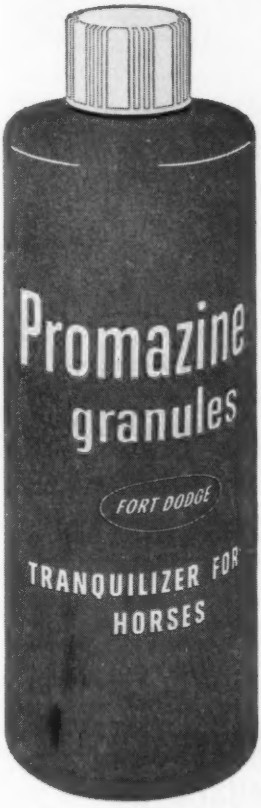
Many old textbooks give 1 grain to 3 grains a day as the average dose of arsenic for a horse. The right amount, and it can be given safely, is 7.5 grains per 1,000 lb. of body weight.

In some sections of the country malignant edema kills more horses than tetanus.

Subacute, terminal and fatal nephritis is not a too infrequent complication of equine influenza.



calm fractious horses



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Blood Supply of the Head of the Canine Femur

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School of Veterinary Medicine
Auburn University
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As early as 1943 the clinical importance of the anatomy of the canine femur was recognized by Nichols.[1] He pointed out that the femur is the strongest and best protected of all the long bones, but is the most frequently fractured. About 1/10 of the femoral fractures occur at the proximal end. According to Greene,[2] canine hip and stifle injuries outnumber many times those of other joints. He further points out that traumatic dislocation of the hip produces many different clinical problems and fractures of the femoral neck and their sequelae sometimes lead to discouraging results. Brinker,[3] in Canine Surgery states that the proximal epiphysis of the femur of very young dogs sometimes separates. If the circulation is seriously impaired there may be absorption of the femoral head, even when prompt immobilization has been provided.

According to Brinker, Schroeder has successfully treated fractures of the femoral neck by use of 2 pins placed across the shaft of the femur in the region of the trochanter. He further reports Stader has advised against attempting repairs in fractures of the femoral neck because of the frequency of necrosis of the femoral head due to interrupted circulation. Stader has, therefore, investigated the use of tantalum for artificial heads of the femur. Brinker also states that the artery of the ligamentum teres furnishes 15% of the blood supply to the head of the canine femur, while the remainder is furnished by arteries of the capsule. However, he does not explain how this is supplied.

Sisson and Grossman[4] describe a lateral circumflex artery which is distributed to the sartorius, rectus femoris, the tensor fasciae latae and the gluteal muscles, all of which are near the acetabulum. They do not include the head of the femur in the distribution of the circumflex artery. Miller[5] describes the distribution of the medial, lateral and superficial circumflex femoral arteries to muscles of this region in the dog but says nothing about their supplying the head of the femur. According to Chaveau,[6] the coxofemoral articulation is supplied with arterial blood principally by twigs from an anastomosis of branches from the deep femoral and obturator arteries. Bradley[7] states the lateral circumflex femoral and the anterior femoral arteries may arise in common from the femoral. He describes the distribution of both of these arteries, but

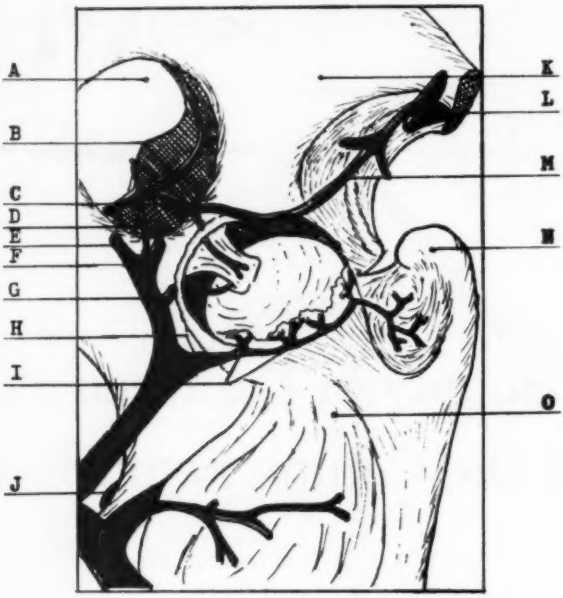

Figure 1. Blood supply to the right femoral head, caudo-ventral view. A. Obturator foramen. B. Superior ischiatic spine. C. Articular branch of the obturator artery supplying the synovial membrane and the round ligament of the femoral head. D. Ascending branch of the obturator artery. E. Muscular branch of the deep femoral artery. F. Muscular branch of the obturator giving off a small branch to the synovial membrane of the capsule. G. Obturator artery. H. Synovial branch of the deep femoral artery. I. Perforating epiphyseal branches of the deep femoral artery. J. Iliopectineal eminence. K. Ischium. L. Caudal gluteal artery. M. Branch of the caudal gluteal artery to the synovial membrane. N. Trochanter major. O. Vastus medialis m.

does not include them in the blood supply to the head of the femur. The deep femoral artery is described by the above authors as a branch of the pudendoepigastric trunk. It is also distributed to muscles adjacent to the acetabulum, but no mention is made of it supplying the head of the femur.

The blood supply to the head of the femur of man is shown by Grant[8] to be derived from 3 sets of arteries: (1) the medial and lateral circumflex femoral arteries supply the head by ramifying in the synovial membrane to the margin of the articular surface where they perforate the bone and anastomose freely with terminal branches of (2) the medullary artery of the shaft, and in 80% of cases, with (3) the artery of the ligament of the head. Thorek[9] states that the hip joint in man is supplied from the gluteal, the circumflex and the obturator arteries. He states Wolcott is of the opinion that the anastomosis between the ligamentum teres vessel, the capsular artery and the nutrient artery of the shaft does not take place until the ossification of the head of the femur is practically, if not entirely, completed. Thorek further states it is Wolcott's belief that the ligamentum teres circulation in man is a closed one so far as the femoral head is concerned until such an anastomosis takes place.

Clinical observations of human cadavers by Chandler and Kreuscher[10] revealed complete healing in 3 instances where fractures of the femoral neck were complete, so the only nourishment to the proximal fragment was through the ligamentum teres. Schmorl[11] reported a similar case of complete fracture of the neck, including the vessels in the synovial membrane, in which union occurred because of blood supply through the ligamentum teres.

The objectives of this study are to investigate and describe the normal blood supply to the head of the femur of the dog, to determine the incidence of nutrient arteries in the ligamentum teres, to search for vessels which might reach the head of the femur by way of the synovial membrane surrounding the neck of the femur and form anastomoses with terminal branches of the medullary artery of the shaft, to observe the number of foramina of the fovea capitis,

and to prepare drawings and photographs of the vessels to illustrate the angiology found.

Experimental Study

The coxofemoral areas of 40 dogs were studied to determine the arterial blood supply to the head of the femur. Twenty-five were mature greyhounds of both sexes. Three were dogs approximately 6 months of age. The remaining 12 were mature mongrels from the dog pound.

The greyhound specimens were sacrificed under anesthesia by exsanguination. A canula was inserted in the right femoral artery and the entire vascular system was then thoroughly perfused with tap water. The fluid was allowed to escape by way of a second canula placed in the right common carotid artery. The deep femoral arteries of 10 greyhounds were injected with red latex, the cranial femoral arteries of another 10 with blue latex and the external iliac arteries of 5 additional greyhounds with yellow latex. All specimens were then embalmed with 10% formalin by the vascular route, using the right common carotid artery. The pelvis and limbs were removed and the complete coxofemoral area dissected with aid of a dissecting microscope. After each specimen was dissected, photographed, and sketched, the ligamentum teres, including its attachment to the femoral head, was removed and prepared for sectioning.

The decalcifying and embedding procedure as described by Dotti, Paparo, and Clarke[12] was selected for use. The sections were cut at 10 microns and stained by a combination of Delafield's hematoxylin and a picro-indigocarmine counter stain. Serial sections were prepared from those ligaments containing arteries with a thick muscular media to trace the course of the vessel into the bone of the head from the ligamentous structure.

The 3 puppy specimens were prepared in the same manner as the greyhounds except that all 3 vascular routes were injected with latex of the same color. The dissections were performed and the ligamentum teres sectioned. The object of this part of the project was to search for possible anastomoses of the sources of femoral head blood supply in the young animal where the epiphyseal plates had not fused. The search was continued by completely corroding the tissues away from the latex casts with concentrated hydrochloric acid.

The procedure for the greyhounds was modified for the 12 mongrel dogs by injection of red latex into the cranial femoral artery rather than into the deep femoral. The subsequent examinations as described were then continued.

Observations

The blood supply to the femoral head of the dog is derived from 3 sources: the deep femoral, the cranial femoral and the

Figure 2. Blood supply to the left femoral head, cranio-dorsal view. A. External iliac artery. B. Deep femoral artery. C. Femoral artery. D. Anastomosis of the lateral circumflex femoral and the cranial femoral artery branches. E. Transverse branch of the lateral circumflex femoral artery. F. Nutrient artery of the femur — a branch of the median circumflex femoral artery. G. Lateral circumflex femoral artery.

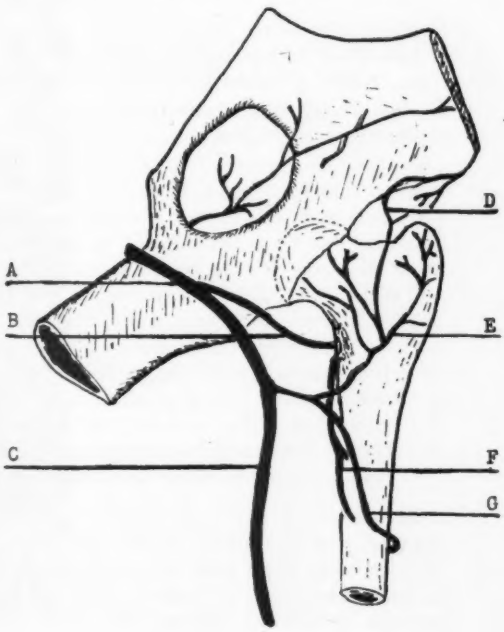

Figure 3. Photograph of the injected femoral head. L. Ligamentum teres. C. Injected end arteries showing through the articular cartilage.

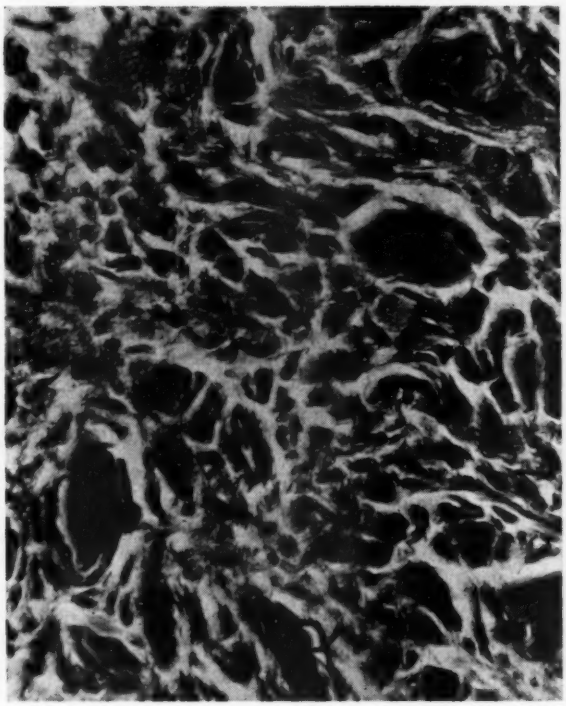

Figure 4. Photomicrograph of a cross-section of the ligamentum teres. X430. A. Muscular artery. B. Bundle of collagenous fibers of the ligament. V. Vein.

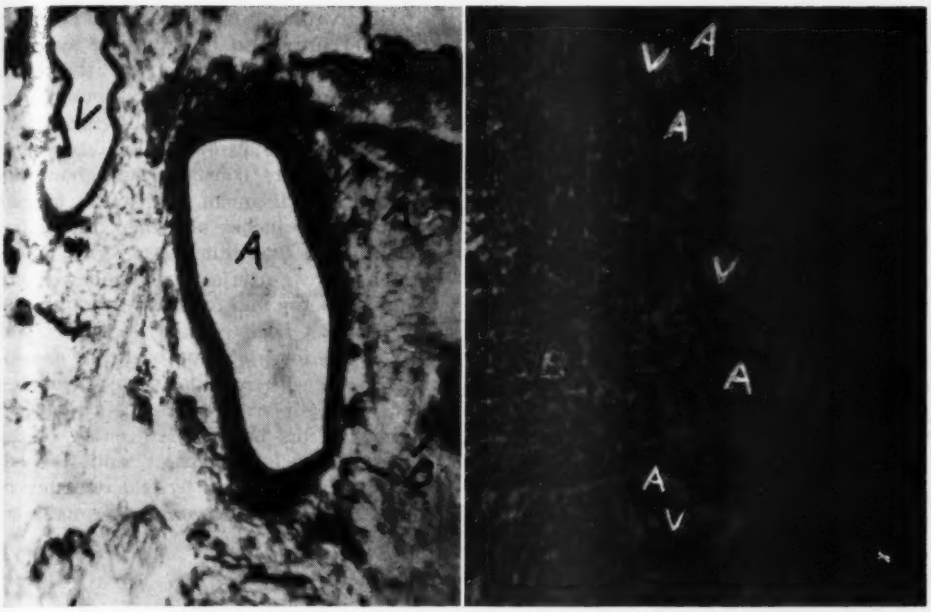

Figure 5 (left). Photomicrograph of a cross-section of the ligamentum teres near the femoral head. X100. A. Muscular artery. B. Bundle of collagenous fibers of the ligament. V. Vein. Figure 6 (right). Photomicrograph of a cross-section of the ligamentum teres near the femoral head. A. Muscular arteries. B. Bundles of collagenous fibers. V. Vein. X100.

caudal gluteal arteries. The synovial membrane is supplied chiefly by the medial and lateral circumflex arteries. These continue in the substance of the membrane to the margin of the articular surface, where they enter the substance of the head by way of numerous slit-like foramina. This supply is constant and appears to be the chief source of femoral head supply. The medial circumflex artery is a branch of the deep femoral. It supplies nutrient branches to the adductor and vastus medialis muscles, supplies the nutrient artery of the femur and anastomoses with the lateral circumflex artery on the caudal surface of the femur. In approximately one-half the specimens, it sends an articular branch through the acetabular foramen to the acetabular fossa. There, it joins a twig from the caudal branch of the obturator artery to ramify in the Haversian fat and loose connective tissue of the acetabular fossa. The end branches of the medial circumflex artery continue to the trochanter major and to the trochanteric fossa area of the femur.

The lateral circumflex artery is one of the end branches of the cranial femoral artery in the dog. It courses ventrolaterally over the trochanter major to which it sends small branches. Synovial branches are supplied to the membrane at the proximal and cranial areas of the femoral neck. These anastomose with the encircling synovial ramifications of the medial circumflex, the deep femoral and obturator arteries, all of which supply the membrane and bone at the articular margin. An anastomosis is formed between the medial and lateral circumflex arteries which encircle the shaft of the femur just below the trochanters.

The deep femoral artery is rather large in the dog. In its caudal course it supplies the branches to medial thigh muscles of its area. Ventromedial to the acetabulum it gives off the medial circumflex femoral

artery and numerous ascending synovial branches. As shown in Fig. 1, these ascending branches supply a constant ring of synovial arteries on the caudodorsal and caudoventral parts of the femoral neck and anastomose with similar branches from the lateral circumflex femoral and cranial femoral arteries. These synovial branches perforate the bone just ventral to the head. Injections reveal a free anastomosis between these arteries and the medullary arteries of the shaft by way of marrow spaces of the spongy bone substance of the head. The epiphyseal scar does not form a barrier and does not interrupt continuance of the marrow spaces in the heads of femurs of mature dogs.

Serial sections of 40 ligamentum teres specimens revealed the presence of muscular type arteries which averaged from 0.5 mm. to 3 mm. in diameter. All ligaments contained vessels. The vessels were larger and more numerous in the superficial less compact portions of the ligament than in the more compact centers. Most of these arteries continued as fine ramifications into the small marrow spaces beneath the thin compact bone shell of the head. This observation is a difficult one to make, as the pores of the fovea capitis accommodate not only the nutrient vessels but numerous collagenous connective tissue fibers as well.

The medullary vascular supply route was studied by injections of the medial circumflex femoral artery at a point just ventral to its exit from the deep femoral. The injection mass was found to course from the medial circumflex artery through its nutrient artery of the femur branch to the medullary arteries of the shaft and thence to the very cartilagenous surface of the head of the femur. Fig. 3 shows injected end vessels visible through the articular cartilage.

Summary

The blood supply to the head of the canine femur is from 3 sources: (1) the supply by the way of the synovial membrane plexus, (2) the arterial supply by way of the ligamentum teres and (3) those branches from the nutrient artery of the femur which penetrate the epiphyseal scar.

Observations reveal the most constant and chief supply to be from the synovial membrane plexus formed by the deep femoral, obturator medial and lateral circumflex femoral and to a small extent from the caudal gluteal arteries. The ligamentum teres arteries are constant throughout the length of the ligament. They are formed as articular branches of either the medial circumflex or the obturator arteries. Ligamentum teres arteries were followed by serial sectioning and found to penetrate the thin compact bone capsule of the femoral head at the fovea. These branches anastomosed freely with medullary artery branches by way of the marrow spaces. Nutrient end branches to the proximal extremity of the femur, the trochanter major, and trochanteric fossa are supplied by end branches of medial and lateral circumflex femoral arteries.

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Paper No. 893, School of Veterinary Medicine, Auburn University, Auburn, Alabama.

Incidence of Infectious Bovine Rhinotracheitis and Bovine Virus Diarrhea

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Pathology Dept., Pitman-Moore Co.,
Division of The Dow Chemical Co.

At least three distinct clinical forms of naturally occurring infectious bovine rhinotracheitis (IBR) infection have been recognized: infection of the respiratory tract,[1] infection of the genital tract (infectious pustular vulvovaginitis or IPV)[2] and a viral conjunctivitis.[3] The virus also has been isolated, in this laboratory, from calves clinically diagnosed as having shipping fever. In these cases, however, bacteria associated with the shipping fever syndrome such as *Pasteurella* spp., *Corynebacterium* spp. and *Streptococcus* spp. were also recovered frequently and pathologic studies usually revealed a fulminating bacterial bronchopneumonia.

Bovine virus diarrhea (BVD), on the other hand, primarily affects the digestive tract. Moreover, recently reported serologic evidence[4] indicates that all strains of virus isolated from cases of either virus diarrhea or mucosal disease that have been studied so far are antigenically related; thus, there may be a common etiologic factor in BVD and mucosal disease. Both the IBR virus and BVD virus have been associated with clinical cases and herd outbreaks of abortion in cattle.

Previously reported studies with IBR and BVD have for the most part been concerned with characterization of these agents and the clinical manifestations of experimental and naturally occurring infections.

Although some information on the geographic distribution of these agents has been obtained incidentally through a number of studies, the possibility that either agent might be ubiquitous has been emphasized only occasionally.[5-9] The purpose of this report is to present evidence that both IBR and BVD infections are widespread in cattle, and consequently should be considered as potential hazards in almost any cattle-raising area.

Serological Survey

The data reported here were obtained over a period of 30 months, during which several thousand bovine serum samples, from both beef and dairy herds, and from many different states, were tested in this laboratory for antibodies against one or both of these agents. The samples fall in two major categories: about half were sub-

mitted specifically to determine whether antibodies against IBR and/or BVD might be present; the remainder were samples submitted for serologic tests for other agents, such as *Brucella abortus, Leptospira* sp., and *Vibrio fetus*, which might be associated with abortions. Since IBR or BVD was suspected in approximately half of the herds, and neither agent was suspected in the remainder, there was some degree of randomization in the collection of these samples.

The IBR virus used in the test system was the Pitman-Moore strain and the BVD virus was the Oregon C24V strain isolated by Gillespie, *et al.*[9]

A standard serum neutralization technic conducted in primary bovine kidney tissue culture systems was used for all tests. The serum samples were screened for IBR antibodies in a 1:2 dilution and for BVD antibodies in 1:2 or 1:10 dilutions against 100 tissue culture doses ($T.C.I.D._{50}$) of virus. Endpoint titers always were determined in paired samples, and frequently in single samples from the herds in which IBR or BVD infections were suspected.

TABLE 1
Results of Serologic Tests

State	Infectious Bovine Rhinotracheitis		Bovine Virus Diarrhea	
	No. Positive/ No. Tested	Percent Positive	No. Positive/ No. Tested	Percent Positive
Alabama	6/84	7	7/84	8
Arkansas	2/3	66	2/2	100
California	4/19	21	18/19	90
Florida	27/63	43	26/39	66
Georgia	3/23	13	5/18	28
Illinois	162/365	44	134/228	59
Indiana	37/165	22	64/122	52
Iowa	145/318	46	159/235	68
Kansas	22/85	26	36/57	63
Kentucky	23/133	17	65/121	54
Louisiana	2/6	33	2/6	33
Maryland	1/1	100	—	—
Michigan	3/7	43	8/8	100
Minnesota	19/51	37	30/46	65
Mississippi	29/83	35	29/53	55
Missouri	14/73	19	35/70	50
Nebraska	152/262	58	149/202	73
New Jersey	0/11	0	10/11	91
North Dakota	8/9	88	7/9	77
Ohio	2/9	22	3/9	33
Oklahoma	27/56	48	38/50	76
Pennsylvania	3/42	7	5/35	14
South Carolina	2/25	8	8/14	57
South Dakota	15/51	29	23/46	50
Tennessee	16/69	23	36/69	52
Texas	23/101	23	44/98	45
Utah	0/2	0	—	—
Virginia	0/2	0	1/3	33
West Virginia	2/8	25	2/8	25
Wisconsin	8/27	30	7/14	50
Wyoming	2/37	5	15/19	79
TOTAL	759/2,190 (31 states)	35%	968/1,695 (29 states)	57%

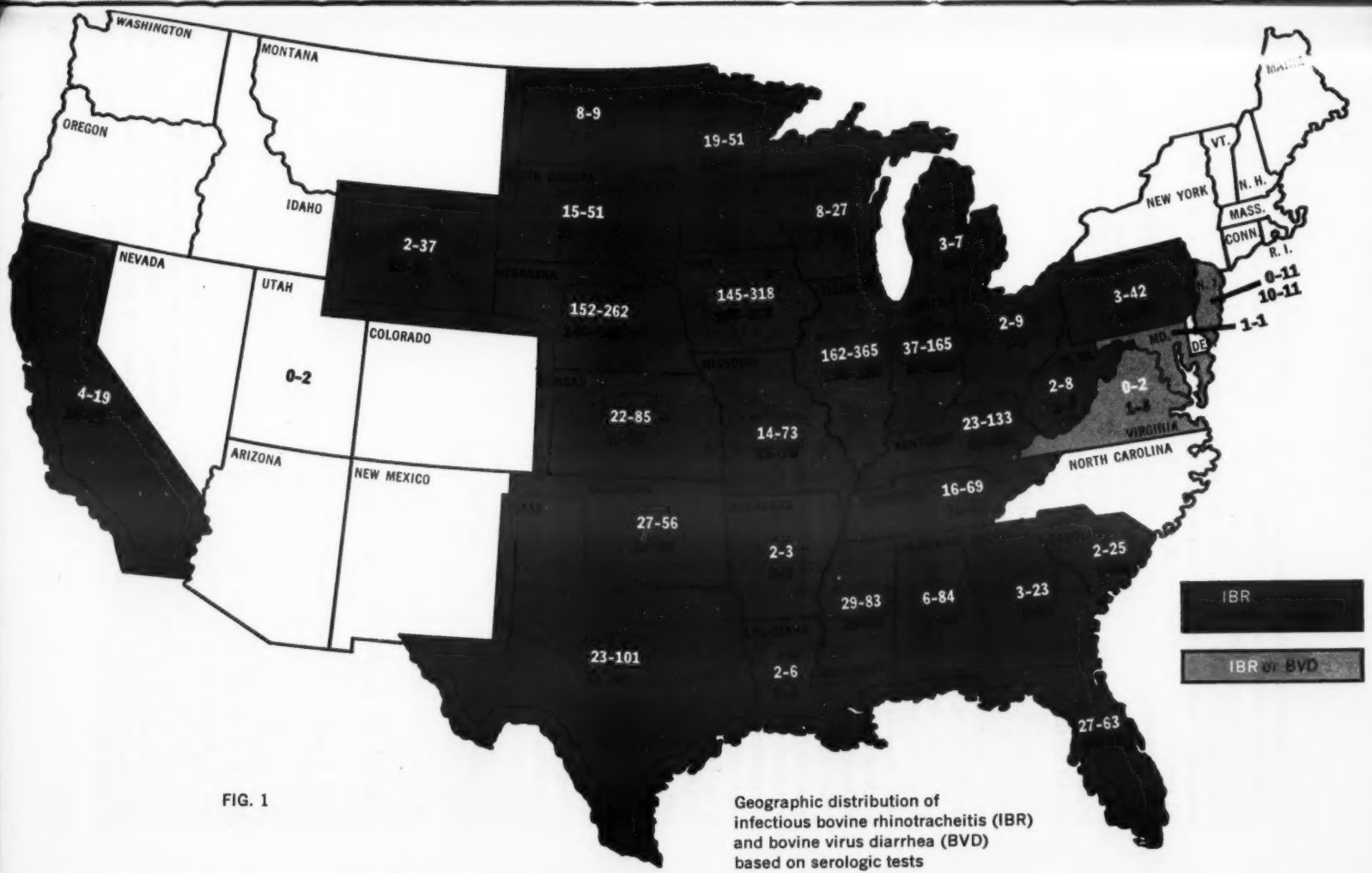

FIG. 1

Geographic distribution of infectious bovine rhinotracheitis (IBR) and bovine virus diarrhea (BVD) based on serologic tests

As shown in Table 1, samples from 31 states were tested for IBR antibodies, and positive tests were found in 28 states; samples from 29 states were tested for BVD antibodies, and positive tests were found in all these states. Of 2,190 samples tested for IBR antibodies, 759 (35%) had neutralizing antibodies; of 1,695 samples tested for BVD antibodies, 968 (57%) were positive. Figure 1 shows the overall distribution revealed by these serologic tests.

Generally, the clinical information obtained was limited, and the significance of some individual percentages is not clear due to the limited number of samples available from certain states. However, the demonstration of IBR antibodies in cattle from 28 of 31 states and of BVD antibodies in all of 29 states, indicates that these agents are widespread. The negative findings from a few states do not necessarily preclude the possibility of the presence of IBR. Transportation of cattle, as currently practiced throughout the United States, makes it almost certain that both agents will be, or have been, introduced into any state in which there is much transhipment of animals.

Summary

Serologic evidence of the presence of antibodies against infectious bovine rhinotracheitis virus was demonstrated in bovine serum samples from 28 of 31 states, and of antibodies against bovine virus diarrhea virus in samples from 29 of 29 states. IBR antibodies were demonstrated in 759 (35%) of 2,190 samples tested; BVD antibodies were demonstrated in 968 (57%) of 1,695 samples tested. These data indicate a widespread distribution of these agents.

ACKNOWLEDGMENT

The authors express their appreciation to Mrs. Mary E. Weidlich for assistance in the compilation of the data, and to Dr. Karl Mayer for reviewing and editing the manuscript. The authors are indebted to Dr. J. H. Gillespie for providing the Oregon C24V strain of BVD virus.

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Effect of Lepto in Sows

After brucellosis, leptospirosis is the most frequent cause of porcine abortion in Hungary. *L. pomona* and less frequently *L. hyos* are the pathogenic agents. Only susceptible sows that contract the infection in late pregnancy abort or deliver premature pigs. The sows may abort without showing signs of any illness. Leptospiras exert no injurious effect on the fetuses of sows less than 2 months pregnant at the time of infection.

The 3 earliest abortions among 800 aborting sows occurred on the 72nd, 76th and 78th day of pregnancy. The pigs born dead or those dying shortly after birth were the larger, well-developed ones. It appears that the well-developed fetuses are the ones chiefly attacked *in utero*.

Leptospirosis does not detract from the breeding value of sows. Once they have aborted, they are immune. They can be rebred and will not constitute any danger because the environment is already infected.

F. Kemenes and Gy. Szemeredi, Acta Veterinaria, 11:1, 1961.

The Place of Research in Private Practice

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Capt. Leonard A. Mika, Ph.D.
United States Air Force

To the veterinarian in private practice, research may seem a remote activity—a time-consuming luxury he feels unqualified to undertake. We should like to dispel some of these ideas and to convince him that because of his training and experience, he actually can perform some creditable research as a part of his practice. Further, results of such efforts can improve the quality of his own services, benefit his colleagues and give him a sense of personal satisfaction and accomplishment.

The practitioner, unlike staff veterinarians in universities and research institutes, cannot feasibly undertake a large amount of research. This limitation, however, should not deter him from venturing into the field of veterinary research. We also anticipate the context of this article will give the veterinarian some insight on various aspects of research and inspire him to undertake it with greater confidence.

The veterinarian is well equipped to aid in biological and medical research, trained as he is to work with animals. Experimental animals may be considered as living laboratory instruments useful in the same way as other laboratory tools, but applicable to uses where ordinary instruments are limited or will not function. The veterinarian recognizes the necessity to calibrate these biological systems in much the same manner as other laboratory instruments are calibrated. He realizes that living instruments must be further standardized by eliminating variables of strain, species, disease and anomaly so they will react in a uniform manner. As a result, numerous standard strains of laboratory animals have been developed and are widely used. The beagle, for instance, is a widely used breed for research, as is the C-54 mouse and the Sprague-Dawley rat.

Practitioners are well aware of the various reactions of animals to disease and are in a position to consider these variables in research. The veterinarian is also considered an excellent observer and accurate reporter. He can detect differences and changes in animals based on his wide experience and professional knowledge.

Three basic elements of research can be considered: the investigator, phenomena to be observed, and a plan of observation.

The Investigator: The successful researcher must have incentive and an inquiring mind, filled with knowledge—knowledge which he can apply by critically thinking out his problems. At times a veterinarian finds his formal education inadequate, particularly in some related needed scientific disciplines. Perhaps his background in mathematics does not give him sufficient grasp of statistical concepts needed to analyze his results. He may find he needs more detailed knowledge in certain phases of physiology or of recent advances. Consequently, he learns as he proceeds; he acquires a basic understanding of

Figure 1. First chimpanzee ever to ride a rocket is given a post-flight physical check by Major Richard E. Benson, D.V.M., after being brought aboard ship following the ride.

related areas; and he becomes proficient in keeping informed of past and current publications.

From this point the veterinarian has 3 choices. First, he may attempt to become expert in these new fields. It would certainly be ideal for a single individual to have the background training of a veterinarian, physiologist, physicist and engineer. This would eliminate many problems of communication and coordination, since these functions would be accomplished immediately in the mind of such a unique individual. However, only in rare instances today do men acquire detailed knowledge in several fields.

As a second approach, he may choose to consult experts to obtain specialized advice. This is an opportunity to utilize highly specalized backgrounds and broad experiences of mature investigators. They can contribute stimulating discussions, present several viewpoints, and provide a critical, though constructive evaluation of various aspects of a problem area.

Thirdly, experience shows that a number of workers possessing various disciplines and devoting their efforts to a single problem can work more effectively together than individually in advancing technical knowledge and accomplishment. For these reasons, the team approach to the solution of research problems is being more widely used. For example, a physician, a veterinarian, a statistician and a virologist may work well together in solving an epidemiological problem concerned with the spread of equine encephalomyelitis from animals to man. When using the team approach, close contact must be maintained between various members of the team to exchange ideas and knowledge. The physician and veterinarian need to be intimately associated with the statistician and the virologist to be cognizant of their viewpoints and understand their concepts. The team members are then able to communicate, exchange ideas and coordinate their efforts most effectively.

Phenomena to Observe: The phenomena to observe might be relatively common natural occurrences, such as the sex of newborn children. These natural events can be observed, recorded and analyzed. In the United States, 106 boys are born for every 100 girls. During childhood, mortalities among males are higher and at the age of about 27 years there are approximately equal numbers of men and women. Thereafter the male population decreases further and among persons 65 years of age and over there are only 84 men to every 100 women. To the best of our knowledge, similar data have not been accumulated regarding any of our domesticated animals or commonly used laboratory species. Possibly such information would be of little or no value. On the other hand, it might be of considerable value.

The United States Air Force at present is vitally concerned with the use of chimpanzees for space exploration tests. Yet there is little available data concerning the normal physiology, growth and dietary requirements of the chimpanzee. If such data had previously been gathered, analyzed and documented, our nation's endeavors in space might now be somewhat easier and quicker. More interesting to the practicing veteri-

nari n are the phenomena concerned with the occurrence of diseases in animals and meth ods of treatment. The hypothetical research problem which follows considers such phenomena in detail.

Phenomena to observe may also be experimentally produced. For the practitioner, however, this is not a practical approach. He must realize that in research one may try to eliminate all variables except one to see if this particular factor results in observable changes. For example, a research veterinarian might wonder if a certain new disease is contagious. He must realize the implications and consequences of this disease and the circumstances which may bring it about. The investigator may then subject normal, unexposed animals to the agent by various means, such as by contact, injection by several routes, scarification or other means. In this way he experimentally induces phenomena which he observes, analyzes and compares with similar observations made on animals under exactly the same conditions except for one thing—exposure to the infectious organism.

The Plan of Observation: The practitioner reaches a stage when he begins to note that 2 conditions or types of reactions apparently result in similar or opposing effects. For example, he may note a considerable number of young dogs with very high fever during distemper later develop chorea. He may speculate why this is true. The speculation or theories may be stated in the form of questions which require an answer. Possible answers to these questions then become hypotheses. To test a hypothesis he needs a plan of observation, *i.e.*, a pattern for making observations.

The Research Process

Many attempts have been made to characterize research. However, these have often been set down as all-inclusive definitions. For instance, research may be defined as a method of progressive search for facts or true actualities and their unbiased analysis. Definitions are not sufficient. To know what research is, to appreciate how it is accomplished, and to understand some of the problems involved, it is necessary to analyze the various steps in the research process.

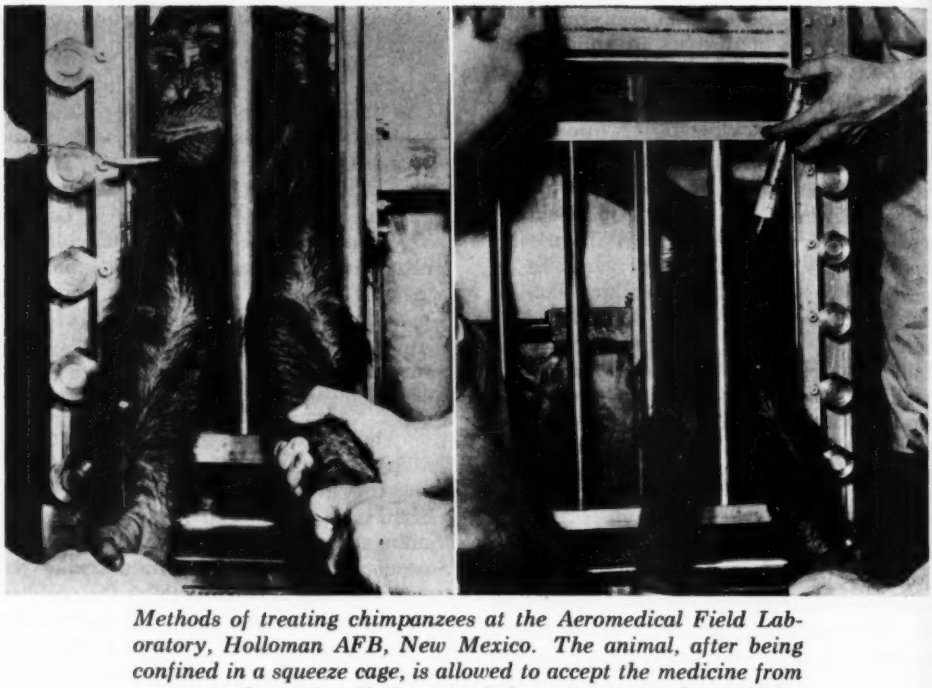
The first step in undertaking research is to formulate the question or state the problem to be solved. This is perhaps the most difficult part of research. The manner in which the problem is defined governs activities that go into the research, *i.e.*, the scope, methods used, kinds of data collected and testing of hypotheses. Those who have written theses and dissertations know the importance of clarity when the problem is formulated. When the statement of the problem is not clear, an individual wastes and minimizes the value of his efforts.

The next step is to formulate hypotheses to answers or solutions to the problem. In formulating hypotheses the veterinarian must consider and evaluate previous findings in areas related to the problem. Speculations which arose from earlier observations and led him to think the problem was worth investigating then become some of these hypotheses. These too must be carefully and clearly stated, as only a few can be selected for investigation.

In formulating the plan for research, the practitioner must decide what data he needs and how to systematically collect, organize and evaluate these data. In essence, he must plan to list the specific data, show how each set of data was obtained and how the data are to be treated to be made meaningful when applied to solution of the problem. He must also consider the need for statistical analysis of the data which will indicate the several conclusions to be drawn from his research efforts.

Finally, when the research is completed, the individual tests the conclusions to see if they fit the hypotheses which were previously formulated, and then sets down his findings in writing so they may be of benefit to his colleagues.

The veterinarian must always be vigilant of certain pitfalls which he may encounter in research studies. One of the most common is that he is not careful enough in choosing the problem to be solved. He probably spends insufficient time in deciding exactly what problem he wishes to solve and



Methods of treating chimpanzees at the Aeromedical Field Laboratory, Holloman AFB, New Mexico. The animal, after being confined in a squeeze cage, is allowed to accept the medicine from a spoon voluntarily. If the animal does not accept the medicine from a spoon, a stomach tube is passed and the medicine is then given through it.

how best to accomplish the solution. The problem must be chosen with care if it is to provide answers to the questions and it will not yield valid results if it is changed during the course of research. It is often desirable in research to hold all conditions constant except one and allow only this one thing to vary during the course of study. When more than one variable is introduced, it is difficult to ascribe differences in results to a specific cause. Sometimes changes are not fully observed and evaluated. When this is allowed to occur the research is worthless or, at best, a poor attempt at solving a problem. It is also imperative that adequate controls be used to do creditable research.

Often we have a dislike for mathematics. To evaluate results of research, we need to appreciate statistical concepts in the design of experiments and in analysis of results. Statistics as a tool can often assure us we are not making assumptions which lead to erroneous conclusions. That two things occur together does not necessarily mean there is a cause-and-effect relationship. Both may be caused by a third or fourth factor which was not observed or controlled. Possibly these two things occurred together merely by coincidence.

A Hypothetical Research Problem

The following stepwise progression of a simple hypothetical problem is one a practitioner might encounter in the field, and it illustrates various steps he would utilize in the research process to solve the problem.

Problem: A new treatment has become available for relapsing ketosis. It has been highly recommended by a friend, a veterinarian who practices in a nearby area, but this recommendation was made following treatment of only 3 cases. Our practitioner has decided to compare and evaluate the efficiency of this new corticosteroid, Com-

pound Z, in relation to another corticosteroid, Compound A, which he has been using in the treatment of relapsing ketosis of dairy cattle.

Formulate Hypotheses: Previously it was observed that intravenous sugar is of limited value in treatment of ketosis, since the rapid rise in blood sugar is followed by an equally rapid drop and the whole effect is gone in a few hours.

In earlier observations the number of relapses occurring in treatment of ketosis has been minimized with corticosteroid Compound A. To provide sufficiently sustained and prolonged steroid therapy, a series of 5 injections was required. When corticosteroid Compound Z became available, it was anticipated that because of the close similarity in the structural configuration of the 2 compounds, one might be able (1) to provide sustained therapy for ketosis in dairy cattle with the new product, (2) to decrease the number of injections required, and at the same time (3) to reduce further the incidence of relapses.

Here the practitioner speculates on the basis of earlier observations that because of similarity of compounds, he might logically expect as much and more benefit from the new compound in the treatment of animals. The hypothesis is stated thus: With the new compound there will be comparable or improved therapy, a decrease in the number of injections to obtain desired results, and a possible reduction in incidence of relapses.

Securing Data: Next, the veterinarian must decide what data he needs, how to collect, organize and evaluate these data systematically, and the type of controls needed to make the study reliable and valid.

The practitioner resides in a locality where a majority of dairy cattle are Guernsey and Holstein breeds in which incidence of ketosis is quite high and where the total number of cases may reach 40 to 50 a year with approximately the same number of each breed being affected. He realizes the use of a placebo is unwarranted in an ethical practice. He knows from published results and from his own experience that corticosteroid Compound A possesses definite therapeutic value and minimizes relapses if prolonged therapy is carried out. In es-

TABLE 1
Comparative Efficacy of Two Corticosteroids in the Treatment of Ketosis in Cattle

Breed	No. of Animals	Compound	Prescribed Regimen (No. of doses)	Observations
Experimental Group				
Guernsey	11	Z	1	Five recovered. Six relapsed, of which 4 required 1 additional injection and 2 required 2 additional doses for recovery.
Holstein	10	Z	1	Six recovered. Four relapsed, of which 3 required 1 additional injection and 1 received 2 additional doses for recovery.
Guernsey	9	Z	2	Good recovery in all.
Holstein	12	Z	2	Eleven recovered. One required an additional injection.
Guernsey	5	Z	3	Good recovery in all.
Holstein	6	Z	3	Good recovery in all.
Control Group				
Guernsey	13	A	5	Eleven recovered. Two relapsed, requiring 1 to 3 additional doses for recovery.
Holstein	9	A	5	Good recovery in all.

sence, this set of conditions will provide the type of control needed for a reliable evaluation. As cases arise, he alternates treatment, using prolonged therapy with Compound A in one case and a predesignated dose regimen of 1, 2, or 3 injections of Compound Z in successive cases. Furthermore, the veterinarian may find individual cases being treated with Compound Z will require additional injections. Therefore, a systematic record must be maintained of number of cases, type of regimen, additional injections of the new compound required to reduce relapses and a complete tabulation of results of treatment.

Analysis of Data: After approximately one year of collecting data, the practitioner has accumulated and tabulated the data shown in Table 1. In Table 2 he has treated the data differently to enhance their value in solving the problem. In this table no distinction is made on the basis of breed, since there are no differences apparent from Table 1 in the way the 2 breeds respond to treatment.

The veterinarian now reaches a point where tentative conclusions may be drawn. Examination of the data reveals the new corticosteroid Compound Z is as efficacious as Compound A in treatment of relapsing ketosis of dairy cattle. A regimen of only 2 injections of Compound Z results in 95% recovery as compared with 91% recovery in the control group when 5 injections of Compound A are given. In addition, the number of repeat calls is kept to a minimum, and therapy with the new compound is both economical and effective. In this particular and rather simple research problem, results are clear-cut. Statistical analysis of the data is unnecessary to confirm the tentative conclusions and the analysis does not require further discussion.

TABLE 2
Effect of Selected Dose Regimen of Two Corticosteroids in the Treatment of Ketosis in Cattle

No. of Animals (Exclusive of Breed)	Compound	No. of Doses	% Recovery
Experimental Group			
21	Z	1	52
21	Z	2	95
11	Z	3	100
Control Group			
22	A	5	91

Conclusions versus Hypothesis: When each conclusion is tested the practitioner finds it fits the previously stated hypothesis. There is comparable and even improved therapy with the new compound. Fewer injections are required to obtain desired results, and the incidence of relapses after the shorter treatment is reduced.

Summary

The practitioner is in a position to undertake a limited amount of research. His formal education and his practical experience provide him with prerequisites for participation in research. If the veterinarian possesses an inquiring mind, the ability to think critically and the incentive, he may embark on research more easily than he realizes. His participation in research will further educate him in processes of scientific thinking. It will give him an understanding of what the research process means and develop his ability to use one or more types of procedures in scientific method. Finally, research will teach him the fundamental lesson of the difference between opinion and fact.

The problem a veterinarian chooses for investigation should constitute a significant contribution to knowledge, but it should also be one feasible for him to undertake and solve. It must be clearly limited and defined so that the principal objective of the study may be attained. Research should be based on data which are original and should never involve a mere exercise of personal opinion. If the research is a revaluation of data secured by other investigators, then improved technics or better interpretation must be added.

In summary, the practitioner's role in research will not only give him great personal satisfaction but will also enhance his professional stature in the scientific community.

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Vaccinated*	45	12 I.U./ml.	33 I.U./ml.	46	40	10
Control	35	10 I.U./ml.	10 I.U./ml.	29	33	19

*Vaccination procedure: two injections of 10 ml. of bacterin-toxoid at four-week intervals.

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The Physiologic Effect of Reserpine on Ewe Lambs

Arthur D. Allen, Ph.D.
School of Veterinary Medicine
University of Missouri

Reserpine, the major alkaloid of *Rauwolfia serpentina,* has been employed therapeutically in the treatment of hypertension and psychotic types of mental illness. It has been shown to possess a specific effect on the metabolism of 5-hydroxytryptamine (5-HT), which is mobilized from the body depots and excreted in the form of 5-hydroxyindolylacetic acid (5-HIAA).[1,2] It had been postulated that reserpine exerted its pharmacological action by inactivating the 5-HY-binding sites of the depots, but it has recently been shown that it modifies the body content of adrenaline to a similar degree. In attempting to distinguish between possible alternative modes of action of reserpine, blood sugar has been used as an indicator of adrenaline action. Reports on the effects of reserpine on blood sugar reach contradictory conclusions.[3,4,5] The effect of reserpine on the thyroid of the rat was observed to be due to hypotensive effect and interference with the renal excretion of iodide.[6] Reserpine interrupted the normal estrus cycle of the rat and produced a galactopoietic effect.[7] Contradictory effects of reserpine were noted on the absolute and relative gland weights of rats.[8,9] Reserpine at levels of 25 micrograms produced weight gains in rats and at levels of 50 micrograms, weight losses occurred.[8] Reserpine, when fed to cattle in a combination with oral stilbesterol and oxytetracycline, has increased weight gains and feed efficiency. Reserpine fed to lambs at a level of 500 micrograms/lb. of feed produced an apparent growth depression in lambs but gave indications of improving carcass quality.[10] Reserpine fed at 5 micrograms and 10 micrograms/lb. of ration had no significant effect on the rate of gain of fattening lambs.[11] The experiment reported in this paper was conducted to determine the effect of feeding reserpine on the weight of different glands, the effect on blood constituents and growth rate.

Experimental Study

Forty western ewe lambs were divided by random assortment into 4 lots of 10 lambs each to be fed a complete mixed pelleted fattening ration. Reserpine (Serpasil, Ciba) was added to the experimental rations before pelleting at the following levels: Lot I, no reserpine; Lot II, .0625 mg./lb.; Lot III, .125 mg./lb.; and Lot IV, .25 mg./lb. The experimental ration for the first 3 weeks consisted of ground corn, 35%; ground alfalfa, 60% and soybean oil meal, 5%. For the remainder of the experimental period, the finishing ration was composed of ground corn, 60%; alfalfa hay, 35% and soybean oil meal, 5%. Ten grams of oxytetracycline per ton were added to each ration. This ration was hand fed twice daily, giving the animals all they would eat at a feeding. Salt and water were available to the animals at all times.

Blood samples were drawn at weekly intervals by a jugular venipuncture. Blood samples were drawn into test tubes containing potassium oxalate as the anticoagulant. A portion of the sample was precipitated with zinc and barium hydroxide solutions for blood glucose analysis. Total white cell counts and blood smears for differential

white cell counts were made as quickly as possible after each blood collection. For white blood cell counts 0.1 N. HCl was used as a diluent and C. L. stain (C. W. Alban Co.) was used for differential counts. Two hundred cells were counted. Hematocrit was determined by the micro-method. Blood samples were centrifuged for 5 minutes at 10,000 r.p.m. in an International "Hemocrit" centrifuge. Hemoglobin was determined by reduction to iron. The animals were weighed at weekly intervals to determine rate of gain and feed conversion. Beginning on the 4th week, 1 lamb was slaughtered from each lot at weekly intervals for 10 weeks. Animals were weighed prior to removal to the abattoir; and after slaughter, the hot carcass weight, chilled carcass weight, and yield were determined. U. S. Government carcass grade was assigned each carcass. The thyroid, thymus, adrenal, pituitary, ovaries and mammary glands were removed from each animal as soon as it was slaughtered, weighed grossly and sections fixed for histological study.

The method of analysis of variance was used to determine if a significant difference did exist between the control lot and lots fed different levels of reserpine. Coefficient of correlation was used to determine whether or not the blood analysis and gross weight of the glands varied significantly from the controls over the period covered by the experiment.

Results

The animals fed .125 mg and .25 mg. of reserpine per pound of feed were less easily disturbed than the control animals or the animals fed the lowest level of reserpine. Means and standard deviation of blood components and absolute gland weights are shown in Table 1.

The adrenal glands in both the control and low-level reserpine lots (I and II) had a significant decrease in weight as the experiment continued (Table 2). The lot fed the highest amount of reserpine showed a

TABLE 1

Means and Standard Deviation of Blood Components and Absolute Weight of Endocrine Glands

	Control Lot I	Reserpine per lb. of Feed		
		0.625 mg. Lot II	.125 mg. Lot III	.25 mg. Lot IV
Thyroid (gm.)	2.32 (.74)*	2.15 (.76)	4.05 (1.99)	2.33 (.39)
Thymus (gm.)	44.64 (12.80)	35.38 (13.44)	48.48 (14.84)	27.58 (8.38)
Adrenal (gm.)	2.06 (.58)	2.00 (.26)	2.09 (.36)	2.14 (.47)
Pituitary (mg.)	451.90 (154.12)	455.10 (121.54)	429.00 (161.70)	456.40 (111.84)
Mammary glands (gm.)	94.66 (18.87)	108.41 (13.64)	103.04 (10.69)	98.96 (15.32)
Ovaries (gm.)	0.96 (.47)	0.86 (.17)	0.94 (.24)	0.81 (.29)
Hematocrit (%)	35.7 (3.07)	36.3 (2.97)	36.2 (3.92)	36.6 (2.99)
Hemoglobin (%)	12.7 (2.14)	12.5 (1.90)	12.6 (2.43)	12.6 (2.32)
Blood Glucose (mg./100 ml.)	65.6 (7.94)	61.1 (7.80)	59.5 (6.78)	58.4 (7.67)
White Blood Cell Count**	7.30 (1.38)	8.02 (1.02)	7.40 (1.12)	7.96 (7.67)
Avg. Wt.	55.13	54.76	53.69	53.41

*Standard Deviation
**Cells/mm.^{3} blood X10^{-3}

significant increase in the weight of the adrenal glands, while the lot fed the medium level of reserpine (Lot III) had no significant change in the adrenal weights. Pituitary weights increased significantly in all lots. Thyroid gland weights were significantly decreased with a longer feeding interval in the low-level and high-level reserpine lots (II and IV). However, in the medium-level reserpine lot (III) there was a significant increase in thyroid gland weights. In histological study, the thyroid glands of the control animals (Lot I) and low-level reserpine (Lot II) were almost all normal appearing in cross-section. Only 3 of the 10 lambs fed the medium levels of reserpine (Lot III) had normal appearing thyroid glands; the remainder showed mild hyperplasia, metaplasia, or rather tall cells with a pale colloid. Thyroid sections in some instances from animals fed high levels of reserpine (Lot IV) showed loss of colloid and hyperplasia; however, the majority of the glands were normal appearing. No significant correlation was observed in thymus gland weights except in Lot III, which had a decrease in the weight of the thymus as the feeding interval increased. Mammary glands showed no significant changes in any of the lambs and no galactopoietic effect was noted. A significant decrease in the weight of the ovaries occurred in all lots; however, this decrease could be attributed to the season of year in which the experiment was performed.

Hemoglobin and hematocrit in all lots increased significantly and white blood cell counts decreased significantly; however, these results could not be attributed to the drug.

Blood sugar levels increased significantly during the experimental interval in animals fed low levels of reserpine (Lot II), but no change was observed in the other lots. Analysis of variance indicated a difference between lots for blood sugar. Analysis of variance showed a significant difference between weeks, but no significant difference between lots in feed consumption.

Because of the system of slaughtering, animals did not grade as high as would have been expected if all animals in all lots had been fed longer and slaughtered when finished. A significant increase in the grade of animals was noted as the length of time on feeding increased in the lots fed low levels and high levels of reserpine, but was not noted in the control lot and medium-level reserpine-fed lot (I and III) over the 10-week period. A significant increase in dressing percentage over this 10-week period was observed in the control lot (I) and the lot (III) fed medium levels of reserpine, but a significant decrease in the lot (II) fed low levels of reserpine. No change was noted in the lot (IV) fed high levels of reserpine.

TABLE 2

Zero Order Coefficient of Correlation, Regression and Standard Error of the Mean of the Absolute Weight of Various Endocrine Glands and Blood Components

		Weight at Time of Slaughter With			
		Lot I	Lot II	Lot III	Lot IV
Adrenals	r	-.49**	-.39**	-.01	.57**
	b	-.10	-.03	.00	.10
	sy	.51	.23	.36	.39
Pituitary	r	.65**	.50**	.64**	.73**
	b	34.9		40.22	28.60
	sy	117.02		123.95	75.97
Thyroid	r	-.18	-.41**	.35*	-.31*
Thymus	r	.28	.28	-.31*	.11
Mammary Gland	r	.21	-.01	-.20	-.21
Ovaries	r	-.56**	-.40**	-.31*	-.54**
Hematocrit	r	.86**	.75**	.86**	.86**
	b	.09	.08	.12	.09
	sy	1.56	1.97	2.03	1.52
Blood Glucose	r	.28	.40**	.17	.06
	b	.10	.14	.05	.02
	sy	7.63	7.14	6.68	7.66
Hemoglobin	r	.93**	.85**	.97**	.88**
	b	.07	.06	.08	.07
	sy	.77	.99	.58	1.10
White Blood Cell Count	r	-.51**	-.34**	-.45**	-.25
	b	-.24	-.12	-.18	-.10
	sy	11.88	9.53	10.66	11.10

*Probability = .01
**Probability = .05

Summary

Reserpine in the ration fed to ewe lambs did not significantly affect gains, feed consumption, carcass yield or grade. At the highest level fed (Lot IV), an increase was noted in the weights of adrenal

glands over a 10-week period. The gross weight of the thyroid decreased significantly over a 10-week period in the lowest level (Lot II) and the highest level (Lot IV) and increased significantly in the lot (III) fed the medium level of reserpine. Blood glucose level increased significantly over a 10-week period in the lowest reserpine-fed lot (II), but no effect was noted in the medium (Lot III) and highest level (Lot IV). No effect was noted on hemoglobin, hematocrit and white blood cell numbers.

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Incidence of Leptospirosis in Deer

Leptospirosis in deer is widespread throughout Illinois and other midwestern states. Further work is needed to clarify the nature of the infection.

A team of investigators studied 419 samples of deer blood taken in 1957 during the first hunting season in Illinois since 1901. Of these, 243 were tested for evidence of infection with Brucella by the rapid plate method and for evidence of Leptospira infection by the agglutination-lysis test with live antigen of 5 serotyes.

Nine of the 13 counties from which samples were taken had positives for one or more Leptospira serotypes; 10.2% of the samples were positive to *L. pomona* and 9.8% were positive to *L. grippotyphosa*. All the Brucella tests were negative.

The investigators point out that the adaptation of deer to the changing habitat of North America is a factor that makes their relationship to domestic animals important. Autopsied deer in Illinois were found to have eaten a very considerable amount of corn. It is probable in states such as Iowa and Illinois, which lack large forested areas, that the deer have invaded farm lands to an even greater extent than deer from the timbered states.

The rise in deer population has been accompanied by increased reporting of leptospirosis in cattle. It is also possible that deer become infected by domestic animals; this seems probable in cases of both *L. pomona* and *L. grippotyphosa*. The nature of this infection and the extent, if any, to which deer constitute a reservoir need to be determined.

Am. Jour. Pub. Hlth., 51:717-722, May, 1961

Notes and abstracts screened from the medical literature for their special interest to veterinarians by Lynn Stratton Morris.

Quick Method to Determine Statistical Significance

Mastery of statistical methods is unnecessary except for the professional statistician. But what is needed by the busy medical practitioner, who would like to follow the literature critically, is a quick method of determining whether the recorded findings in a small number of cases have significance.

Dr. Harry Beckman of Milwaukee, Wis., presents a "quickie" method for forming a reasonably reliable judgment of the significance of such findings. It is one that Alan Gregg, late director of the Rockefeller Foundation, used for many years; it was brought to his attention by the mathematician, R. A. Fisher.

Here it is:

Let "a" = the number of positive reactors

Let "b" = the number of negative reactors

Then, if $\frac{(a-b)^2}{a+b} = 4.0$ or more, you can be reasonably sure that the finding begins to be within the significant range.

Examples: In a study in which there were 76 patients, all treated alike with a certain drug, 45 gave the response that was hoped for and 31 did not; then $\frac{(45-31)^2}{(45+31)} = 2.5$, and the findings are not indicative of more than chance occurrence. But if 48 had given the positive response and 28 had not; then $\frac{(48-28)^2}{(48+28)} = 5.2$, and significance may be well considered.

Some basis for forming a quick and serviceable judgment also is needed in situations in which significance is claimed for a certain mean figure representing status in a treated group as compared with the mean figure, together with its standard deviation, of the untreated controls.

Dr. Beckman suggests projecting the standard deviation of the mean of the control twice in either direction; then, if the new figure is not greater than this projected figure, either above or below, the alteration produced by the use of the drug is not greater than might have been produced by chance alone.

For example, suppose the mean titer of a drug recoverable from the plasma of an adequate number of individuals is 18.6 ± 3.2 mg./%, and the titer in the plasma of a group treated with a potentiator in the hope of raising this figure is 30.0; then 18.6 with its standard deviation extended twice becomes 25.0, and the new figure is significant. But if the standard deviation of the 18.6 figure had been 6.4 instead of 3.2, the extended figure would have been 31.4, and the new figure of 30.0 would have been of very doubtful significance. Or if the mean had been the original 18.6 ± 3.2 but the

new figure only 28.0, there would have been much doubt of the latter's significance.

Wisconsin Med. Jour. 60:258, April, 1961

Value of Intra-Articular Corticosteroid Injections

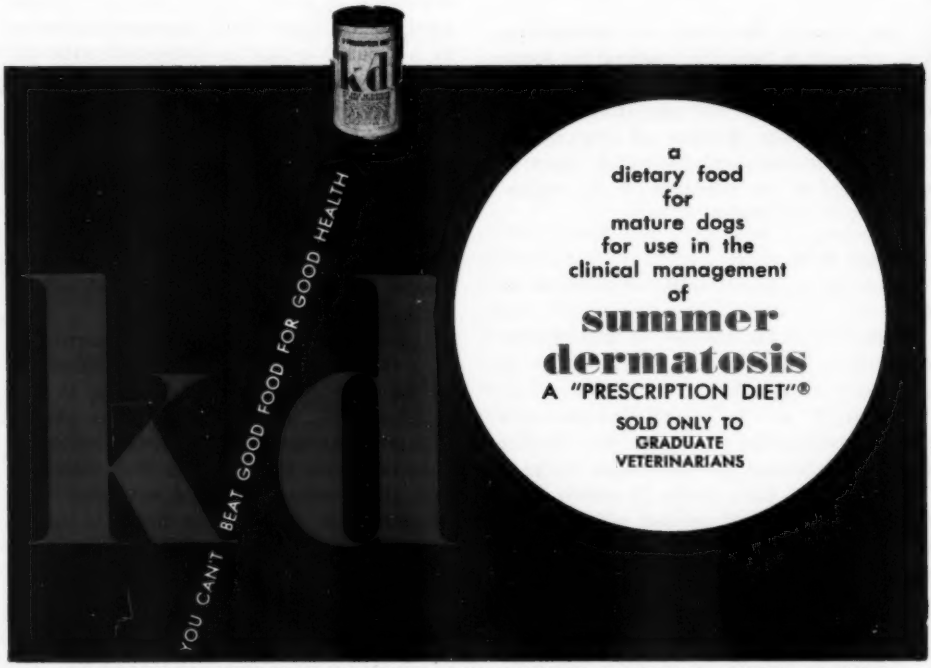
The value of injecting anti-inflammatory corticoids into the synovial space (adjacent to the joints and bursa) "has proved its usefulness," report developers of the technic, Drs. Joseph L. Hollander, Ralph A. Jessar and Ernest M. Brown, Jr., of the hospital of the University of Pennsylvania.

Reviewing the results of 100,000 injections in 4,000 patients since they first began intrasynovial therapy 10 years ago, the team declared that the method relieves local inflammation produced by practically every form of arthritis, bursitis and tendinitis.

Combined results of short- and long-term local therapy show that 90% of the patients benefited. The report appeared in the Arthritis and Rheumatism Foundations' *Bulletin on Rheumatic Diseases.* Where the disorder is self-limited, a single injection into a traumatic joint or an inflamed bursal or tendon sheath often suppresses the overt manifestations indefinitely.

Similarly, if any chronic systemic disease flares up locally, such as acute gouty joint, the single injection plus indicated systemic treatment usually produces long-lasting remission of local symptoms and signs.

Repeated injections must be given when the local symptoms are themselves chronic, as in rheumatoid arthritis and osteoarthritis. Compared to an untreated group, their patients had the same extent of joint deterioration, but functionally the joints fared well.



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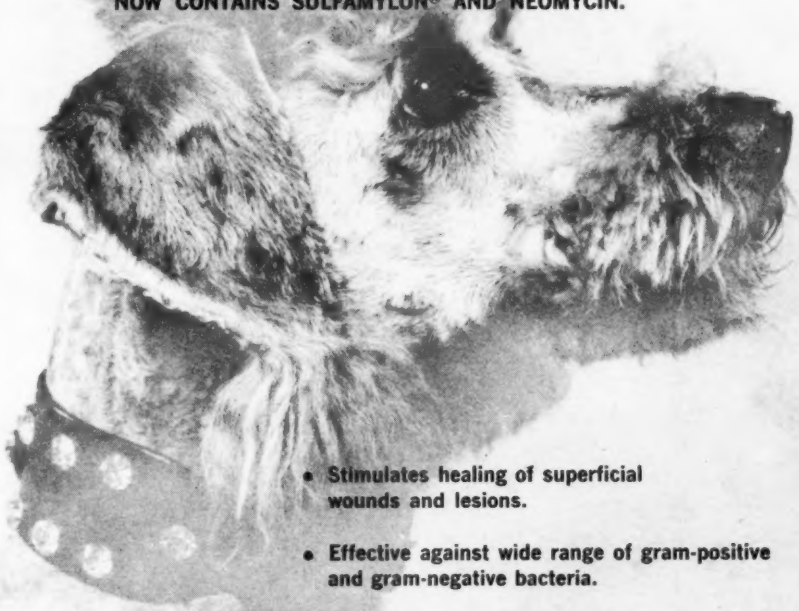

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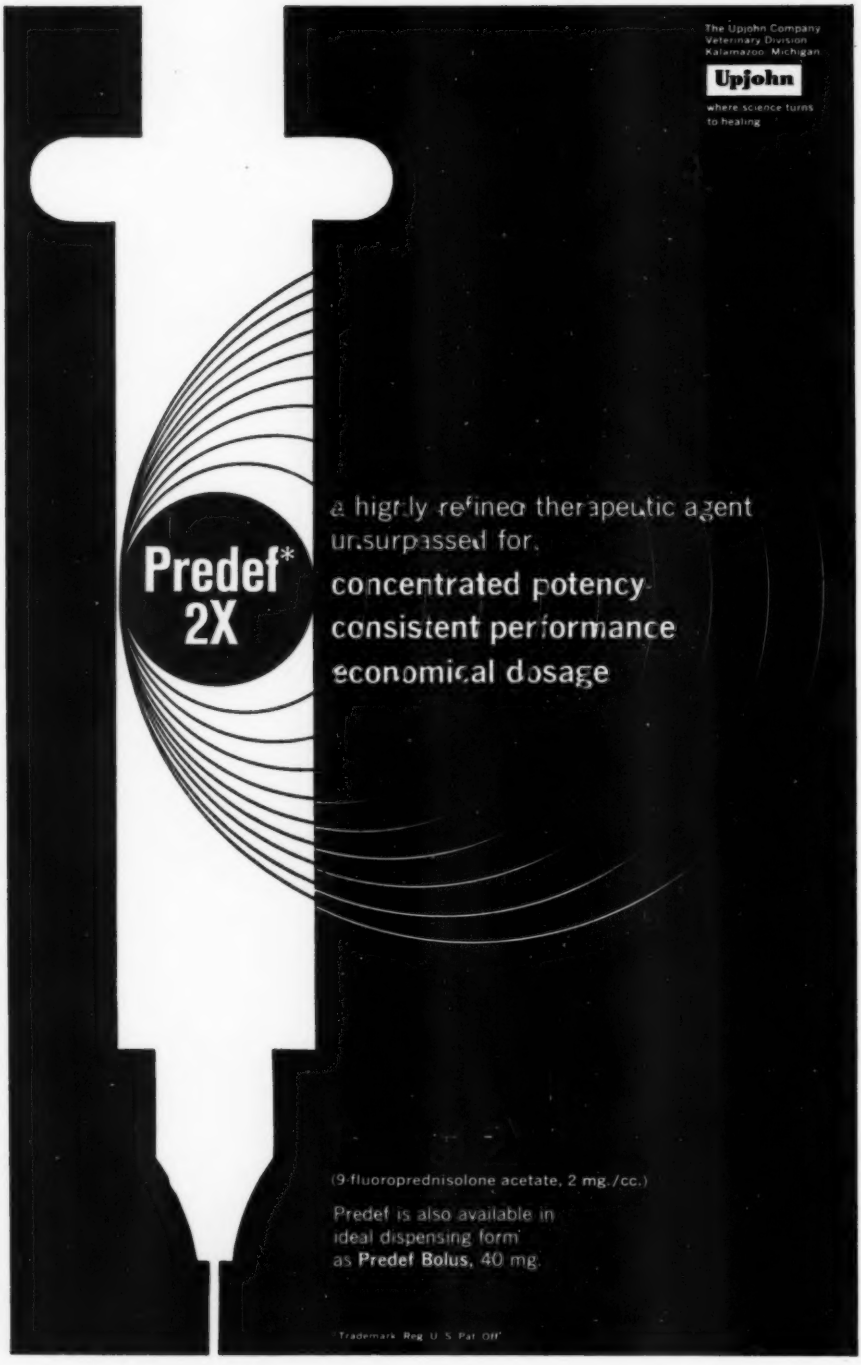
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